VOL. XXXV. PART 12 DECEMBER, 1956

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COMMONWEALTH MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

VOL. XXXV DECEMBER 1956

C. A. I.
4 JAN 1957
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PIERI (G.). **Indagine sulla diagnosi della 'degenerazione infectiva' della Vite con mezzi chimici. (Nota preliminare).** [Research on the diagnosis of 'infectious degeneration' of the Vine by chemical methods. (Preliminary note).]—*Ann. Sper. agr.*, N.S., 9, 6, *Suppl.* pp. lxxxix-xciii, 1955. [English summary.]

At the Experimental Station of Vine Cultivation and Oenology, Conegliano, Italy, when leaves from healthy European and American vines were submitted to Lindner's colorimetric test for the presence of virus disease [*R.A.M.*, 29, pp. 312, 602], the reagent turned green, but when the leaves used were taken from vines affected by infectious degeneration [court-noué: 35, p. 579], it assumed a yellow to red tinge, the colour depending on the severity of the symptoms.

SUHOV (K. S.) & RAZVYAZKINA (Mme G. M.). Биология вирусов и вирусные болезни растений. [Biology of viruses and virus diseases of plants.]—228 pp., 'Soviet Science' Publisher, 1955. Roubles 8.90. [Abs. in Природа [*Nature = Priroda, Moscow*], 45, 4, p. 124, 1956.]

Part one of this book is devoted to the spread of phytopathogenic viruses in nature with special attention to their multiplication and circulation in insect vectors. Part two deals with the development and spread of numerous virus diseases of the most important agricultural crops grown in the U.S.S.R. and their control. A wide use is made of the works on viruses by Soviet and foreign authors, many of which are listed in the bibliography.

YARWOOD (C. E.). **Deleterious effects of water in plant virus inoculations.**—*Virology*, 1, 3, pp. 268–285, 1 fig., 7 graphs, 1955.

Much of this article is an expanded account of information which has already been noticed [*R.A.M.*, 31, p. 316], with some new findings. Bean (*Phaseolus vulgaris*) leaves inoculated with a virus-water suspension of tobacco mosaic virus and then washed for ten seconds become more infected than unwashed leaves, but washing for over 20 seconds had the opposite effect; with a virus-phosphate-water suspension washing always decreased infection. Following three hours in air at 31° C. after inoculation or nine at 20° infection could no longer be reduced by floating leaves with their inoculated surfaces on water for one hour. The addition of potassium monohydrogen phosphate [33, p. 203] to the inoculum or to the wash water usually prevented the otherwise inhibitory effect of water on infection. This effect was shown also with tobacco necrosis, tomato spotted wilt, apple mosaic, and lucerne mosaic viruses. The deleterious action of water in virus infections is hypothetically explained on the assumption that certain ions, necessary for the attachment of virus particles to a suitable site for multiplication, are diluted or removed by the water.

PANZER (J. D.). **Plant virus local lesions in relation to osmotic pressure.**—*Diss. Abstr.*, 16, 3, p. 439, 1956.

At Ohio State University Pinto bean [*Phaseolus vulgaris*] plants grown in 1 per cent. glucose or 2 per cent. sucrose and inoculated with tobacco mosaic virus [cf. *R.A.M.*, 34, p. 489 and preceding abstract] developed fewer lesions than similar plants in distilled water. There was no decrease on plants in 1 per cent. sucrose.

Subsequent investigations on the effect of osmotic pressure on the number of virus lesions revealed that in general the number decreased with a rise in osmotic pressure in solutions of glucose, sucrose, or calcium chloride but increased in potassium sulphate solutions. Numbers were further influenced by the time of inoculation, no reduction occurring unless the plants were placed in the solutions at least two days prior to inoculation.

The osmotic pressures of sap expressed from Pinto bean leaf blades, petioles, and pulvini were 7·169, 8·552, and 11·75 atmospheres, respectively, and when these parts were inoculated with tobacco mosaic virus no lesions developed on the pulvini, few on the petioles, and many on the leaf-blades. When other bean varieties were placed in sucrose solutions, increases in lesion numbers occurred at all concentrations (0·6 to two atmospheres). When Pinto beans were germinated in mineral salts solutions and then transferred to distilled water and inoculated with tobacco mosaic virus or were kept for the whole of the growing period in single salt solutions of nitrogen, potassium, phosphorus, iron, or in a micrometabolic element solution no lesions developed. In mineral salts cultures the most lesions were obtained in complete Meyer's solution, followed by solutions deficient in potassium, then phosphorus, then nitrogen. Lesion numbers were highest in leaves with either high magnesium content accompanied by low potassium and calcium, or high calcium with low magnesium and potassium; and also with high phosphate accompanied by low nitrate and sulphate. In Meyer's solutions of various osmotic pressures, significant increases in lesion number occurred at 0·2 to 0·3 atmospheres and at 0·6.

EGLE (K.). **Probleme der 'Pflanzenquarantäne'. Zum 50-jährigen Jubiläum des Deutschen Pflanzenschutzdienstes.** [Problems of plant quarantine. Contribution to the 50-year jubilee of the German Plant Protection Service.]—*Umschau*, 56, 7, pp. 193–196, 3 figs., 1956.

This is an interesting account by the Director of the State Institute for Applied Botany, Hamburg, of the methods and problems of the quarantine legislation operated by the German Plant Protection Service, with special reference to the work carried on in the port of Hamburg, the largest German exchange centre for plant products. According to K. Böning in *Pflanzenschutz, Wissenschaft u. Wirtschaft, 1954*, 2, 1954, plant diseases and pests are responsible for an annual loss of nearly three milliard DM. of the total output of the Federal Republic, estimated at 20 milliards. The list of [unspecified] micro-organisms subject to quarantine regulations in Germany comprises three viruses, two species of bacteria, and 17 fungi in addition to about three dozen insect pests.

**Report of the Rothamsted Experimental Station for 1955.**—255 pp., 1956.

In his report on the work of the Plant Pathology Department (pp. 89–106) [cf. *R.A.M.*, 35, p. 583] F. C. BAWDEN states, in the section dealing with virus diseases (pp. 89–100), that a virus causing a mosaic disease of legumes in Nigeria [cf. 35, p. 415] was ascertained to be serologically related to tobacco mosaic virus and to southern sann-hemp [Crotalaria southern] mosaic virus from India. No strain of tobacco mosaic virus studied has infected leguminous plants systemically. The viruses from Nigeria and India, although not identical, both underwent similar changes when transferred from leguminous to tobacco plants. When obtained from systemically

infected tobacco plants, both resembled the Rothamsted type strain of tobacco mosaic virus, but when obtained from systemically infected French beans (*Phaseolus vulgaris*) they differed markedly from it. In many plants they caused different symptoms, they were only remotely related serologically to the type strain, they had different electrophoretic mobilities, and they differed in their resistance to inactivation by ultra-violet radiation. A single passage through bean or tobacco produced these changes, and inoculum from single local lesions underwent the same changes as the original bulk inoculum. The change from the bean to the tobacco form and vice versa was found to depend on the species of plant infected and the environment in which it is growing, but whether the change from one form to another represents a reversible mutation or a phenotypic variation is uncertain; the changes in serological and physical properties induced by passage through different hosts may arise from changes in the protein moiety of the virus, the nucleic acid remaining constant.

A. Kleczkowski suggests that all the components specific to plants infected by tobacco mosaic virus may not be serologically related, as hitherto believed. Using the gel-diffusion test, with a layer of agar between those containing antiserum and virus, preparations were found to be serologically heterogeneous, and serologically distinct components, all of which were specific to infected plants, were detected. After removal of the accompanying protein by incubation with citrate or trypsin, preparations still gave more than one line of precipitation when tested against antisera by the gel-diffusion method. A crystallized preparation of tomato bushy stunt virus also contained two serologically unrelated antigens not detected in healthy plants.

In the report of the Botany Department (pp. 70–79) by D. J. Watson investigation of the effect of tobacco mosaic virus on the respiration of tobacco leaves is described by P. C. Owen [35, p. 492]. Infected leaves were placed in three groups, those inoculated, younger leaves then present but not inoculated, and leaves formed after inoculation, and the respiration rates were compared with those of healthy leaves. In inoculated leaves the rate increased within an hour of inoculation, long before virus multiplication was detectable, and this increase remained roughly constant for three weeks, when the plant showed systemic symptoms, the leaves contained the maximum amount of virus, and the respiration rate fell below that of the controls. Respiration in the uninoculated leaves of the second group was not affected. In those of the third group the rate was 10 per cent. below that of the controls.

Preliminary experiments on the comparable effect of severe tobacco etch virus showed the immediate result of infection to be smaller than that caused by tobacco mosaic virus.

In the report of the Biochemistry Department (pp. 80–88) by N. W. Pirie it is stated (p. 84) that from tobacco plants infected with tobacco mosaic virus [cf. 35, p. 794] many preparations have been made of a non-infective antigen, related to the virus but with a much smaller particle size. It resembles the virus in containing firmly bound ribonucleic acid, being undigested by the common proteolytic enzymes, and aggregating readily *in vitro* to give similar rods to those of the virus. It contains only a third to a tenth as much nucleic acid as the virus, but some nucleic acid is always present regardless of the strain of the virus or the environmental conditions.

G. H. Wiltshire reports further studies on the organic acid content of French bean leaves and its relation to susceptibility to infection with tobacco mosaic virus [cf. 35, pp. 346, 746]. Additional acids were found in the leaves, and the content of each acid can be varied with different treatments of the leaves. The greatest changes in acid composition accompany darkening of the leaves; considerable reduction in susceptibility is induced by detaching the leaf.

Correlation between susceptibility and the concentration of any one acid was lacking.

In the Plant Pathology Department B. KASSANIS found that the strains of potato virus S [35, p. 584] present in the Arran Victory and King Edward varieties differ in several respects. The evidence was compatible with the view that the aberrant strain of virus S universally present in King Edward plants is paracrinkle virus [cf. 35, pp. 481, 537]. In conflict with the view that this is a strain of virus S is the fact that Arran Victory plants which contain virus S develop severe symptoms when grafted with scions from King Edward. Other experiments, however, demonstrated that virus S from Arran Victory and the serologically related virus from King Edward multiplied in originally virus-free Profijt potato plants without mutual interference. The view that paracrinkle virus arose endogenously as a component of King Edward plants is unnecessary. Observations suggested that it is merely a specialized strain of a widely prevalent virus, other strains of which are aphid-transmitted, and though the strains infecting potatoes are not, they may have originated from strains that were (as in the case of carnation latent virus) and may have lost this property as well as the ability to infect such plants as carnations during their protracted existence under tuber propagation. King Edward potato plants apparently free from paracrinkle virus and from anything precipitating specifically with antiserum to potato virus S were produced by agar culture of the apical shoot meristems and subsequent grafting to tomato plants to produce sizeable shoots, which were struck as cuttings.

MARION A. WATSON states that the stock of potato virus C (strain of potato virus Y) used ten years ago has been continuously maintained by inoculation in series to *Nicotiana* sp., and the virus has now been transmitted by *Myzus persicae*, the same techniques being used that previously failed. That the change in transmissibility represents a change in the virus during its existence in *Nicotiana* sp. is suggested by the fact that new cultures of virus C in tobacco, obtained, like the original one, from Edgecote Purple potato plants, were not transmitted by *M. persicae*.

The different abilities of virus Y and individual isolates of virus C to be transmitted by aphids did not appear to be correlated with any difference in their distribution in the tissues of infected leaves. When leaves infected with Y and isolates of C were exposed to ultra-violet radiation, the proportional drop in the infectivity of the expressed sap was the same, suggesting that all the viruses were at a higher concentration in the epidermis than in deeper tissues.

From barley plants at Rothamsted presenting leaf symptoms suggestive of barley yellow dwarf virus [35, p. 761] MARION A. WATSON and T. MULLIGAN obtained a virus transmitted by three species of aphids, *Rhopalosiphum padi* transmitting it the most readily. Tests were complicated by the fact that virus-free aphids caused localized, yellow, partly necrotic lesions. Infected oats turned red, making them a better experimental host than wheat or barley. In a field experiment with small plots of Plumage Archer barley, plants infected on 25th April gave only 66 per cent. as much grain as the uninfected; for those infected on 3rd May the figure was 84 per cent.

T. W. TINSLEY found that lucerne plants at Rothamsted were infected with a virus the host range of which agrees with the American descriptions of lucerne mosaic virus, its properties *in vitro* also suggesting it to be a strain of the latter. The electron microscope showed it to consist of spherical particles approximately 14 m$\mu$ in diameter. What is apparently a strain of bean yellow mosaic virus [34, p. 430] was isolated from nursery stocks of gladiolus, and a similar virus was very prevalent in red clover.

H. L. NIXON and H. L. FISHER report on new techniques for preparing specimens to be examined by the electron microscope. Experiments were conducted to ascertain whether tobacco mosaic virus in tissue could be impregnated with solu-

tions containing heavy atoms in order to raise its density sufficiently to render virus particles easily visible in sections still containing the embedding plastic. Both silver nitrate and phosphotungstic acid at pH2 stained purified virus, but exposure to pH2 destroyed the leaf tissue, even when already fixed. A typical tobacco hair cell measuring $2{\cdot}5 \times 10^5\ \mu^3$ was found to contain about $6 \times 10^7$ tobacco mosaic virus particles, or 240 per $\mu^3$.

L. Broadbent and G. D. Heathcote continued their experiments on the insecticidal control of the spread of leaf roll virus and rugose mosaic caused by virus Y on potatoes [33, p. 407]. Aphids were few in spring, but multiplied rapidly during July, and DDT emulsion did not check infestation as thoroughly as before. In the second week of August there were 6,000 aphids present per 150 leaves on the unsprayed crops, as against 2,500 on plots sprayed on 13th June and 14th July, 1,200 on those sprayed on 13th June and 5th and 27th July, and only 550 on those sprayed on 13th and 23rd June and 5th, 14th, and 27th July. Further reference to these investigations is also made (p. 128) in the Report of the Insecticides and Fungicides Department by C. Potter (pp. 112–130).

Observations on potato plants grown from tubers saved from experiments made in 1954 showed that systox, parathion, endrin, and DDT emulsion stopped the spread of leaf roll but decreased the proportion of plants with rugose mosaic by only about one-quarter. At Clavering, Essex, where hanane or systox was either sprayed on the foliage or dribbled on to the ridges three times, or parathion was sprayed on the foliage six times, leaf roll did not spread, whereas its incidence increased five times (to 26 per cent.) in the untreated plots. Rugose mosaic increased in all plots, by seven times to 35 per cent. in unsprayed plots, and by six times to 28 per cent. in sprayed ones.

In further work on the host range and properties of the turnip viruses the Edinburgh and Northumberland strains of yellow mosaic virus [35, p. 585] were inactivated by heating sap for ten minutes at temperatures between 75° and 80° C.; turnip crinkle virus was similarly inactivated by heating to 80° to 85°. Both viruses were transmitted from infected to healthy plants when the leaves were in contact in a wind-tunnel through which air was flowing at 5 m.p.h. Turnip crinkle virus has so far been found only on one farm in Kincardineshire. It causes necrotic local lesions in *Chenopodium amaranticolor* and *Gomphrena globosa* and becomes systemic in *Datura stramonium*, *Reseda odorata*, and *Cleome spinosa*. Dr. C. Martini (Bonn) found that both viruses could be transmitted immediately by flea-beetles [*Phyllotreta* spp.] that had fed for a few minutes on infected leaves. In similar conditions, flea-beetles transmitted yellow mosaic virus more often than crinkle virus but transmitted less often when fed for more than a day than if fed for not more than 12 hours.

Marion A. Watson obtained a virus from wild beet which causes discrete yellow or pale green rings in sugar beet; in old leaves these rings coalesce, forming a characteristic pattern of green rings on a yellow background and the virus is provisionally termed 'water mottle'. It does not afford protection against sugar beet mosaic virus, but both are transmitted alike by [unspecified] aphids and may produce similar symptoms. The water mottle virus differs, however, in causing the under surface of the main veins to become necrotic, so that the leaves bend backwards. The necrosis may also affect the petioles and kill the leaves. The virus gives more and better defined local lesions in tobacco than does mosaic virus, and twice during the winter became systemic in inoculated tobacco plants. Whether it is distinct or an aberrant strain of beet mosaic virus has not yet been determined.

J. W. Blencowe and R. Hull found that various isolates of beet yellows virus consistently produced symptoms of different severity. Titrated against virus antiserum, the sap from plants with the severest symptoms also gave the highest precipitation end-point. Isolates most virulent towards sugar beet either failed to infect *Capsella bursa-pastoris* or gave only a mild disease, whereas those least

virulent towards sugar beet caused severe stunting and turned the older leaves purple. The diseases caused by the isolates in *Chenopodium virgatum* and *Nicotiana clevelandii* in general paralleled in severity those produced in sugar beet, but isolates that caused vein etch and yellowing in beet sometimes produced only one or other of these symptoms in *N. clevelandii*.

Beet plants infected with any of eight isolates causing various degrees of yellowing and etching were protected against subsequent infection by the most virulent isolates. Not only did the characteristic symptoms caused by the virulent strains alone fail to develop, but plants infected with the less virulent strains and colonized 14 days later with aphids carrying virulent ones gave roots of the same weight as plants infected with the less virulent strains, and heavier than those from plants infected with the virulent strains only. Yield of roots was correlated with severity of leaf symptoms; uninfected plants in pots gave roots averaging 19·2 gm. in weight, as against 4·8 for plants infected with the most virulent strain, 12·8 for those infected with the less virulent strain, and 8·8 for those infected with both strains. In field plants of commercial beet varieties there was no evidence of this interference between strains, plants infected simultaneously with a virulent and an avirulent strain giving no better yields than plants infected with the former only.

R. Hull noted that a chlorosis of beet seedlings raised from the inbred line H2S appeared to resemble the Irish '41' yellows [33, p. 407]. Seed from one plant gave 8 per cent. and that from another 20 per cent. of yellowed seedlings, seed from one cluster sometimes producing both healthy and yellowed seedlings. The causal agent, presumably a seed-transmitted virus, was carried by aphids from affected to healthy seedlings. It did not protect plants against subsequent infection with yellows virus.

J. W. Blencowe, D. H. Firth, L. F. Gates, and R. Hull conducted experiments at Cambridge, Bury St. Edmunds, Norwich, and Boston to determine how insecticidal spraying affects the incidence of yellows in the root crop. One day after the third spraying at Cambridge there was a geometric mean of 90 *Aphis fabae* individuals per plant on the unsprayed plots, as compared with one of 22 on those sprayed with systox and one of 4 on those sprayed with metasystox. Plots sprayed with a commercial formulation of DDT in oil (a satisfactory aphicide for potatoes) had as many aphids as the unsprayed.

At Bury St. Edmunds spraying with systox or metasystox in the middle or at the end of June reduced the incidence of yellows to one-fifth, and spraying on both occasions was no more effective than spraying on either one only. A spray in mid-July was effective only at Norwich. A mid-June application of DDT emulsion reduced the incidence of yellows by two-thirds, but later applications had no effect. At the end of August fewer than 15 per cent. of the plants were infected.

The effects of two applications of metasystox on the incidence of yellows were determined in 16 experiments. Under 5 per cent. of the plants were affected by yellows at the end of August on the unsprayed plots of eight experiments, and in only four experiments were more than 10 per cent. of the plants affected. Spraying decreased the incidence of yellows, prevented (in most experiments) the development of large aphid infestations, and kept the plants reasonably free from aphids for 7 to 14 days. At Dunholme, where the plots were surrounded by plants artificially infested with viruliferous individuals of *Myzus persicae*, systox and metasystox reduced the incidence of yellows by one-third at the beginning of September and by one-eighth in mid-October; endrin and DDT emulsion had no effect, whether used alone or applied with systemic insecticides. No cultural treatment greatly affected the incidence of yellows; the best response (about 1 ton per acre of beet) to spraying three times with systox was from plots with full fertilizer and high plant population.

J. W. Blencowe, in a survey of *Beta vulgaris* ssp. *maritima* in East Anglia,

found that most plants examined were infected with beet yellows virus or beet mosaic virus or both, but they were not colonized by aphids in the summer. *Peronospora schachtii* was locally abundant.

In the Mycology section of this report (pp. 100–106) J. M. Hirst and O. J. Stedman state that when over 400 potato tubers infected with *Phytophthora infestans* [35, p. 586] were planted in an unheated greenhouse or in the open 11 per cent. of the former (as a result of infection from the tubers) and none of the latter produced stem lesions. The influence of environment was further shown by the appearance of stem lesions in July, despite dry weather, on some potato plants in tall grass. Five years' observations on the occurrence of weather conditions fulfilling Beaumont's criteria [cf. 35, p. 319] showed that in wet summers there is little advantage in making measurements within the crops, but in average or dry years forecasts based on such measurements are more reliable than those made four feet above the ground.

Evidence was obtained confirming the view that the dew balance can be used to measure the time that apple leaves remain wet, and it would seem that the design of a simpler balance might allow greater accuracy in the timing of curative sprays against scab (*Venturia inaequalis*) [35, p. 777].

E. W. Buxton reports that serious outbreaks of pea wilt (*Fusarium oxysporum* f. *pisi*) and of foot rot (*F. solani* f. *pisi*) [35, p. 411] occurred in south-eastern England, wilt being particularly prevalent in Essex. A bacterium (not yet identified) was consistently isolated from peas grown in north Suffolk and was occasionally found in association with *F. oxysporum*. Inoculated to Onward and Charles I peas in the glasshouse, either organism alone caused a mild disease, whereas both together caused the lower leaves to wilt and collapse.

In a field experiment in which soil was artificially inoculated, *F. solani* spread along pea rows more rapidly than *F. oxysporum*, while simultaneous inoculations with both fungi decreased their rate of spread. Evidence obtained indicated that the formation of heterocaryons may alter the pathogenicity of *F. oxysporum* f. *pisi*. Heterocaryons formed between two mutant strains (each weakly pathogenic) produced from a virulent wild-type culture by exposure to ultra-violet radiation were as pathogenic as the original wild type. Cultures were derived from single spores formed by heterocaryons between physiologic races 1 and 2 of *F. oxysporum* f. *pisi* and three out of $10^8$ of these combined properties from both races. The new combinations of properties were detected by studying the nutritional requirements of the cultures and their ability to tolerate the growth products of an actinomycete [35, p. 213]. Two cultures combining properties from races 1 and 2 infected a variety of pea not attacked by either race and previously found to be susceptible only to race 3. It seems that *F. oxysporum* has a system resembling the parasexual cycle of other Fungi Imperfecti, which, allowing different nuclei occasionally to exchange genetic material, may be one factor responsible for the development of new races.

Exudates from the roots of pea varieties that resist infection by a given physiologic race of *F. oxysporum* inhibited the germination of its spores. Exudates from young roots inhibited more strongly than those from old ones. Sections through inoculated roots showed that races unable to produce wilting in a variety were checked in the outer layers of the cortex. Extracts from lesions caused by *F. solani* in stem bases suppressed spore germination in *F. oxysporum*, though extracts from normal stem bases did not. This may explain why infection by both fungi causes a less severe disease than the wilt caused by *F. oxysporum* alone.

E. W. Buxton and F. T. Last report that irradiated suspensions of the spores of *Botrytis fabae* [cf. 35, p. 64] or *Uromyces fabae* produced many more infections when the spores were exposed to the light before being inoculated to plants or when the inoculated plants were exposed to light, than when they were kept in the dark. Experimental evidence suggested that germination increases resistance to inactiva-

tion by ultra-violet radiation, indicating that when the fungus has penetrated the epidermis it is protected from the radiation. Irradiating broad bean leaves increased their susceptibility to infection by *B. fabae*, but had no effect on inoculation with *U. fabae*. The technique used to measure the infectivity of *B. fabae* conidia is dealt with in the report of the Insecticides and Fungicides Department (p. 129). It consisted in rubbing a drop of a conidial suspension of the fungus over the upper surface of half-leaflets of broad beans with the finger, keeping the detached plants standing in water in a water-saturated atmosphere at 20° to 25° for 24 hours, and then counting the lesions.

I. Macfarlane states that when resting spores of *Plasmodiophora brassicae* [35, p. 586] were exposed to different amounts of ultra-violet radiation and then inoculated to cabbage seedlings growing in water culture two effects followed: (1) loss of ability to produce zoosporangia in infected root hairs and (2) loss of ability to infect root hairs (an effect which is also caused to some extent by direct sunlight, even through glass). Dosages too small to reduce infection left only 5 per cent. of the spores able to develop to the stage at which zoosporangia formation becomes possible and such spores were less effective than normal ones in causing 'club' formation.

In the report of the Insecticides and Fungicides Department it is stated (p. 129) that the effect of griseofulvin on the development of club root of cabbages (*P. brassicae*) was found (in investigations by F. T. Last in association with I. Macfarlane) to be associated with the concentration of *P. brassicae* spores in the soil. When griseofulvin was added to the soil at the time of inoculation, the range of inoculum concentrations varying by a factor of 625 but all giving 100 per cent. infection and clubs of equal size (dry weight) in the controls, the highest concentration of griseofulvin gave the greatest reduction in the size of the clubs, and at all dosage levels griseofulvin was most effective against the lowest concentration of inoculum. Its inhibitory effect appeared to diminish after six weeks.

The rate of increase in size of roots already infected was retarded by the application of griseofulvin to the soil, and it was indicated that a similar result could be obtained by spraying the foliage. Application of griseofulvin to the soil two weeks after inoculation gave better results than that at inoculation or four weeks later. Retardation in club-root development was associated with increased dry weights of foliage and healthy roots.

In the report of the Plant Pathology Department (Mycology) Mary D. Glynne, G. A. Salt, and D. B. Slope state that weather conditions strongly favoured the development of eyespot (*Cercosporella herpotrichoides*) in wheat sown in October, but crops sown late were checked by cold in January and became less severely infected. Ergot (*Claviceps purpurea*), formerly rare, now occurs almost every year on wheat at Rothamsted [cf. 32, p. 477, *et passim*]. White-straw disease (*Gibbellina cerealis*), not known to occur elsewhere in Britain, was again recorded on wheat.

Mary D. Glynne and D. B. Slope tested the effect on lodging in Proctor barley of sowing seed at 1, 2, and 3 bush. per acre at different levels of nitrogen (0, 1½, 3, and 4½ cwt. ammonium sulphate per acre). There was much less lodging than the year before, but again it tended to increase with increasing seed rate and nitrogen.

Cappelle wheat sown on 15th October after a crop of potatoes that had received farmyard manure gave a yield of 65½ cwt. per acre on some plots. The conspicuous differences in yield and quality of grain when wheat followed different crops were associated with a much higher incidence of eyespot (*Cercosporella herpotrichoides*), take-all (*Ophiobolus graminis*), and weeds in the crop following wheat. Field data gave further evidence that Cappelle wheat possesses some resistance to eyespot.

In experiments by J. M. Hirst and G. A. Salt attempts to produce skin spot

on potato tubers with cultures of *Oospora pustulans* [35, p. 586] from underground parts of growing potato plants and from affected tubers failed. At seven places where observations were made the seed tubers of the varieties Majestic, Orion, and Dr. McIntosh had skin-spot lesions, and plants of these varieties at all centres together averaged, respectively, disease ratings of 60, 56, and 48 per cent., whereas Ulster Supreme, the seed tubers of which were unaffected, averaged only 10 per cent. The average ratings of these varieties at the different centres ranged from 23 per cent. on black fen soil to 68 per cent. on clay with flints.

L. F. Gates reports that at 11 of 12 experimental sites sugar beet seed soaked in ethyl mercury phosphate and dusted with BHC gave an average of 10 per cent. more seedlings than seed dressed with mergamma. In small-scale trials captan was almost as effective as ethyl mercury phosphate. Pouring a solution or suspension of fungicide along rows drilled with seed dressed with ethyl mercury phosphate gave an average of 6 per cent. more seedlings.

When conidia of *Peronospora schachtii* were placed by C. E. Cornford at intervals of a few days on the leaves of sugar beet seedlings, all the plants of the inbred line N485 remained healthy, though between 88 and 98 per cent. of the seedlings of five other inbred lines were killed.

In the Report of the Insecticides and Fungicides Department F. T. Last presents evidence (p. 130) that powdery mildew (*Erysiphe graminis*) [34, p. 778] of barley can reduce yields.

**Food investigation.** *Rep. Fd Invest. Bd. Lond., 1955*. 76 pp., 1956.

In the fruit, vegetables, and plant products division of this report [cf. *R.A.M.*, 35, p. 507] R. G. Tomkins (pp. 43–51) refers to further studies on lenticel rotting (*Gloeosporium* [*Neofabraea*] *perennans*) of apples, carried out in the Ditton Laboratory, Kent, in which the pathogen was cultured on detached leaves of Cox's Orange Pippin and also found in infected orchards after leaf-fall [see below, p. 901]. In field trials in co-operation with East Malling and Long Ashton Research Stations spraying orchards with captan in August and September reduced rotting to some extent [see below, p. 902] but a post-harvest dip of captan did not. The development of *N. perennans* was retarded in lightly infected fruit by storage in 5 per cent. carbon dioxide with 3 per cent. oxygen but not when infection was heavy.

The chief organisms associated with the rotting of Kent strawberries in 1955 (assessed by the 'Howard Mould Count' [16, p. 536]) were *Mucor piriformis* and *Botrytis cinerea* [35, p. 349]; in plate counts the yeast *Kloeckera apiculata* predominated. Fruit infected with *Sphaerotheca humuli* gave high mould counts although the fungus does not cause rotting.

E. C. Bate-Smith (pp. 53–62) reports from the Low Temperature Research Station, Cambridge, that fresh potatoes are less liable to attack by *Fusarium caeruleum* than stored, owing to their high chlorogenic acid content [cf. 35, p. 484]. The fungus possesses a latent phenol oxidase system which is stimulated in the presence of phenols to produce brown products less inhibitory than the original phenols. There is also a phenol dehydrogenase system not dependent on the presence of phenols.

In flax, the amount of chlorogenic acid present was not correlated with rust [*Melampsora lini*] resistance, but its quantitative relation to the total phenol content is probably important.

**Third Annual Report, 1955–1956, Scottish Horticultural Research Institute.**—40 pp., 1 pl., 2 maps, 1956.

In the plant pathology section (pp. 22–25) of this report [cf. *R.A.M.*, 35, p. 349], by C. H. Cadman, the author states that strawberry sap was more effective than raspberry sap in inhibiting infection of *Nicotiana glutinosa* by tobacco mosaic virus

and French bean [*Phaseolus vulgaris*] by tobacco necrosis virus, the degree of inhibition being greater with leaf than with root extracts; raspberry sap from winter-raised seedlings was not inhibitory. The inhibitors are dialysable and are precipitated by unclarified sap from healthy leaves of tobacco or French bean but not by heat-clarified sap. Inhibition by raspberry sap is possibly due to the presence of polyphenols that combine with the viruses reversibly, but do not inactivate them. With Kathleen S. Anderson the author reports that the incidence of veinbanding virus [31, p. 615] doubled annually in a trial with Lloyd George raspberries, systox spraying giving some control.

Searching for possible hosts of raspberry leaf curl virus [cf. 35, p. 618], B. D. Harrison found on plantain (*Plantago major* and *P. lanceolata*) a strain of tobacco mosaic virus described in the United States but new to western Europe.

J. Chambers noted that raspberry plants were not freed from vein chlorosis [31, p. 614], veinbanding, or yellows [32, p. 682] viruses by exposure to 35° C. for 30 days.

In experiments by C. H. Cadman and B. D. Harrison potato leaf roll virus was transmitted to *Physalis floridana* by *Myzus persicae*, but not by *M. ascalonicus* or *Macrosiphum euphorbiae*, recorded as vectors elsewhere. Transmission occurred occasionally after one hour's acquisition feeding and more regularly with longer periods, but with less than 36 to 40 hours there was generally a latent period. Exposure of the infective aphids to 32° C. for three to six days greatly decreased their ability to transmit, and maintaining them at 20° for a further period did not increase this, indicating that the virus does not multiply in the vector.

In the mycology section (pp. 26–27) W. R. Jarvis reports further investigations on the resistance of strawberry to *Phytophthora fragariae*, using the varieties Talisman, Royal Sovereign, and Climax. In uninfected roots the terminal oxidase is cytochrome oxidase, but little polyphenol oxidase activity was observed either in healthy roots or in culture filtrates of the pathogen. Using paper chromatography a substrate of polyphenol oxidase, probably chlorogenic acid, together with another, was identified from the roots of the varieties tested. A third was detected only during the summer.

Observations were made, by means of a spore trap, on the distribution of spores of *Botrytis cinerea* [cf. previous page], in strawberry plantations. The concentration of spores increased with rising humidity and temperature and fell rapidly as the distance from the sporulation source increased.

Streptomycin used as a foliage spray and for seed treatment effectively decreased the amount of halo blight (*Pseudomonas medicaginis* f. [sp.] *phaseolicola*) on French beans in field and glasshouse [cf. 34, p. 696].

The report from Auchincruive by R. D. Reid includes mycological investigations by Isabel G. Montgomerie (p. 32) showing that four physiologic races of *Phytophora fragariae* can be distinguished, using the strawberry varieties Perle de Prague, Climax, Auchincruive No. 11, and Aberdeen as indicators. Resistance to all the races tested has been found in some seedlings of *Fragaria virginiana* raised from American seed.

Harris (R. V.). **Plant Pathology.**— *Rep. E. Malling Res. Sta., 1955*, pp. 37–43, 1956.

This report [cf. *R.A.M.*, 35, p. 348] notes further studies on *Pseudomonas morsprunorum* on cherry [35, p. 779], in which streptomycin sprays applied in the autumn of 1954 were found to reduce the inoculum potential very little, but markedly to decrease the number of canker infections recorded in May, 1955. A spring Bordeaux mixture spray (6–9–100) was ineffective, but although a white bud application on young Napoleon cherries was of little use alone, when followed by a petal fall spray it almost halved infection.

Joint studies with the Biochemistry Section in relation to scab (*Venturia* [*pirina*]) [34, p. 770] showed young leaves of Conference pear to contain more of the active aromatic constituent, chlorogenic acid, than those of the less resistant William. The chemical nature of the organic nitrogen source and its quantity in relation to aromatic constituents are the decisive factors in resistance; chlorogenic acid is more inhibitory in the presence of complete aromatic complexes.

Possible mechanisms responsible for tolerance of wilt (*Verticillium albo-atrum*) in hops [34, p. 817] include modifications of root cell wall structure, which bar the pathogen from the vascular cylinder, and development of tyloses in the vessels, compensated for by enhanced secondary wood production to maintain water transport. An isolate of *V. albo-atrum* attacking the tolerant variety OR 55 was found not to be a new strain; two other cases of wilt in this variety were attributable to a combined attack of *V. albo-atrum* and canker (*Fusarium sambucinum*). Investigations on *Verticillium* spp. in soil in the absence of a host showed that *V. albo-atrum* was the least vigorous of four parasitic species, produced no resting mycelium, and was the most profuse sporulator. Infection of tomatoes could result from inoculum particles less than 0·25 mm. in size and at a concentration of 1 per cent.; they have an infective persistence in soil of at least three months and indicate the ability of wind-borne dust to spread the disease. Positive inoculations of undisturbed hop roots were obtained with water suspensions of conidia of *V. albo-atrum*. The pathogen was obtained from inoculated groundsel (*Senecio vulgaris*) and was observed on the surface of roots of *Chenopodium album*.

Direct isolation of the apple collar rot fungus (*Phytophthora cactorum*) [35, p. 103] from soil was easier than from trunk lesions. Worcester Pearmain apple stems and M. II stocks showed resistance to highly pathogenic strains of the fungus. Excision of lesions by bark scaling afforded very good control in one orchard.

Cross transmissions suggest that apple mosaic virus [35, p. 615] is identical with plum line pattern virus [peach line pattern virosis virus: cf. 35, p. 686]. A die-back of Cox and Bramley apples associated with 'star-cracking' of the fruit [35, p. 303] was graft transmissible. An undescribed vein yellowing disease of pears was also graft transmitted.

The susceptibility of all cherry varieties tested to the leaf roll virus [35, p. 305] indicated that carrier varieties are unlikely to occur, and the disease at present therefore seems to be very limited in extent. Indexing tests indicate its identity with the Pfeffinger virus disease [35, p. 775]. Two strains of plum bark split virus [34, p. 770] were identified, and the presence of plum pox virus [35, p. 199] locally has been confirmed.

Indications were obtained of two types of virus strain in the strawberry virus 1 group [strawberry mottle virus: 32, p. 573], and strain variations within virus 2 and 3 categories [mild yellow edge and crinkle viruses: loc. cit.] makes the distinction between virus 3 and 4 [vein chlorosis virus: loc. cit.] less clear [cf. 35, p. 378]. Virus 1 can be permanently inactivated by exposure of plants for two weeks at 37° C. Viruses 2 and 3 were less susceptible to heat [32, p. 262], and anomalous results with virus 4 confirm its indistinctness from virus 3. Indexing of declining loganberry plants on indicators used for raspberry viruses showed the presence of one or more viruses, now to be determined.

Natural transmission of hop nettlehead virus [cf. 35, pp. 326, 474] was shown to occur from April to June; the virus is not always fully systemic. Field records indicated that latent split leaf blotch virus [loc. cit.] may be found in some of the important hop varieties, but no sensitive indicator has yet been discovered. Fuggle hops, being unable to stand prolonged exposure to temperatures above 90° F., cannot be freed of hop mosaic virus [35, p. 348] by this treatment.

Investigations on the control of apple scab [*Venturia inaequalis*] and mildew [*Podosphaera leucotricha*: 33, p. 238] have shown the dosage of lime-sulphur per

acre to be critical. In paint-gun tests with concentrate sprays at a constant dosage per acre small volumes favoured control, but, undiluted, they were no better than the normal dilute hydraulic application. A medium volume at medium concentration, while giving good control, caused most leaf scorch, though not more than the corresponding 2·5 per cent. lime-sulphur hydraulic application if applied pre-blossom.

Spring and early summer injections of 8-hydroxyquinoline potassium sulphate into plum wood artificially inoculated with *Stereum purpureum* in the previous autumn checked the development of silver leaf symptoms, and although the volume of stained wood in such trees was greater than in uninjected controls the fungus was less successfully isolated from the former, the implications of which are being investigated.

Conners (I. L.). **Thirty-fifth Annual Report of the Canadian Plant Disease Survey, 1955.**—xxi+130 pp., 4 figs., 1956. [Mimeoprinted.]

In the section of this report [cf. *R.A.M.*, 35, p. 160] dealing with new or noteworthy diseases (pp. ii–iv) [duplicated in French] it is stated that severe outbreaks of wheat glume blotch (*Septoria nodorum*) [31, p. 596] and wheat speckled leaf blotch (*S. avenae* f.sp. *triticea*) [*Leptosphaeria avenaria* f.sp. *triticea*: 27, p. 230] occurred in the Prairie Provinces. In some otherwise promising oat varieties in Eastern Canada *L. avenaria* has become destructive [34, p. 629].

Two distinct leaf spots of lucerne are caused by *Pseudoplea trifolii* and *Stemphylium botryosum* [*Pleospora herbarum*: 35, p. 21], according to observations in Manitoba. It was also noted that the black stem disease of sweet clover [*Melilotus* sp.], previously attributed to *Ascochyta meliloti* [*Mycosphaerella lethalis*: 24, p. 315; 31, p. 493], is caused by *Cercospora davisii*.

The new rust-resistant sunflower, Beacon, exhibited only traces of *Puccinia helianthi* [35, p. 102].

Merion bluegrass [*Poa pratensis* var. Merion] was attacked by *Puccinia graminis* [cf. 32, p. 193] in Winnipeg and Regina, and by *P. poae-nemoralis* [cf. 31, p. 124] in Alberta.

On tomato *Stemphylium solani* was recorded for the first time in Canada.

In the Okanagan Valley, British Columbia, the close association of apricot ring pox virus [cf. 34, p. 304] and cherry twisted leaf virus [29, p. 313] is being investigated.

Among diseases noted on trees and shrubs were *Rhizothyrium abietis* on *Abies balsamea*, constituting a new record for North America, and *Taphrina dearnessii* on *Acer rubrum* in Quebec. Dutch elm disease (*Ceratostomella ulmi*) [35, p. 157] is spreading steadily in Ontario and Quebec.

On ornamental plants powdery mildew (*Erysiphe cichoracearum*) was important on begonia, and *Cumminsiella mirabilissima* [cf. 30, p. 630] was collected on *Mahonia*, both in Ontario, the latter being a new record. The second North American collection of *Uromyces scillarum* was discovered on a herbarium specimen of *Hyacinthus* collected in British Columbia in 1919.

Simmonds (J. H.). **Science Branch. Plant Pathology Section.**—*Rep. Dep. Agric. Qd, 1953–54*, pp. 55–56, 1954; *1954–55*, pp. 51–52, 1955.

It is stated in the first report [cf. *R.A.M.*, 34, p. 135] that *Gloeocercospora sorghi* and *Ramulispora sorghi* have been newly recorded on sorghum in Queensland and are also new records for Australia. The first is confined to the sorghum varieties Plainsman and Caprock, the second attacks a wide range of sorghums, including Sudan grass and *Sorghum almum*; both cause extensive leaf damage.

The host range of *Colletotrichum graminicola* [15, p. 280] in Queensland now

includes grain sorghums, Sudan grass, Johnson grass (*S. halepense*) and broom millet [*Panicum miliaceum*].

Stem rot of cowpea (*Phytophthora* sp.) [35, p. 351] was again serious. The varieties Blackeye and Chinese Red proved completely resistant, and Cristaudo was among those showing high field resistance.

Extensive collar and root rot of citrus in northern Queensland was attributable to *P. parasitica* [23, p. 296], the relative susceptibility of citrus varieties proving different from that to *P. citrophthora*. Sodium orthophenyl phenate plus hexamine gave good control of blue mould [*Penicillium italicum*] of citrus in storage but was less effective against stem-end rot (*Phomopsis* [*Diaporthe*] *citri*). With 1 per cent. salicylanilide in wax emulsion the position was reversed while the standard 4 per cent. borax-2 per cent. boracic acid dip was intermediate.

The mean water blister (*Thielaviopsis* [*Ceratocystis*] *paradoxa*) infection of pine-apple was reduced by a dip in 1 per cent. salicylanilide in wax emulsion from 39·9 in untreated fruit to 4·9, and by 1 per cent. thiram to 16·6.

*Corynespora cassiicola* [32, p. 342], commonly causing spotting of mature leaves of papaw in northern Queensland, was also observed on immature fruits, the spots varying from black specks surrounded by a water-soaked halo to jet-black zonate areas up to 1 in. in diameter.

Breeding of French beans [*Phaseolus vulgaris*] resistant to rust [*Uromyces appendiculatus*] continues [34, p. 425]. Dusting with sulphur gave the most effective fungicidal control of this disease.

*Sclerotium rolfsii* was responsible for a collar rot of custard apple seedlings, a foot rot of wheat, and a basal rot of lucerne.

In the second report it is stated that the wheat varieties Lawrence, Celebration, Festival, Spica, and Three Seas showed excellent resistance to stem rust [*Puccinia graminis*] which was severe during the year reviewed. *Fusarium* crown rot [cf. 21, p. 250] caused extensive damage to wheat in certain areas. A stalk rot of sorghum was caused by *Sclerotium bataticola* [*Macrophomina phaseoli*: cf. 34, p. 706].

Four cowpea diseases newly identified were a wilt caused by *F. oxysporum* f. [*F. bulbigenum* var.] *tracheiphilum* [cf. 35, p. 504], to which Blackeye 5 is resistant, a leaf spot (*Helminthosporium vignae*) [*Corynespora cassiicola*: see above], *Verticillium* wilt, and spotting of leaf, pod, and stem by *Cladosporium vignae* [cf. 33, p. 117].

A serious stem rot of ginger was caused by a species of *Fusarium*.

It was found that to control banana leaf spot due to *Cercospora musae* [*Mycosphaerella musicola*] and *Cordana musae* a complete cover spray was more effective than regular heart leaf sprays. Cyclonic disturbances were followed by a number of symptoms in bananas, mostly leaf abnormalities, including dwarfing, puckering and chlorosis, rotting of the heart leaves, and corm rots. At Brookfield a few Lady Finger plants developed leaf yellowing and vascular discoloration during the winter reminiscent of Panama disease [*F. oxysporum* f. *cubense*]. No causal organism could be found, and recovery occurred in the summer.

**Plant disease survey for the twelve months ending 30th June 1955. Twenty-fifth annual report N.S.W. Department of Agriculture. Biological Branch-Division of Science Services.**—35 pp., 1 map [? 1956. Mimeographed.]

Some of the information in this report [cf. *R.A.M.*, 35, p. 2] has been noted from other sources [cf. 35, p. 351]. Leaf distortion of unknown cause but perhaps attributable to climatic factors was present in several crops of maize in the Mur-willumbah area of the North Coast in summer and early autumn, sometimes affecting almost the whole crop.

Red rot (*Physalospora* [*Glomerella*] *tucumanensis*) replaced mosaic as the most important disease of sugar-cane, causing the loss of 252 tons of cane, compared with 105 in the previous year. Pineapple disease (*Ceratostomella* [*Ceratocystis*]

*paradoxa*) was less prevalent than in previous years, following the use of organic mercurial fungicides, so also was chlorotic streak virus, but the widely grown variety Trojan is susceptible to the latter.

Bacterial leaf blight (*Pseudomonas syringae*) of red clover (*Trifolium pratense*) was newly recorded in the State at Oberon, appearing in patches during January, but disappearing with drier weather. In autumn, 1955, a large proportion of the subterranean clover [*T. subterraneum*] pastures in the south of the State were affected by stunting and little leaf, a new disease causing stunting of the entire plant and reduction in the size of the central leaves, which were cupped and occasionally had chlorotic margins. The disease appeared first on the south coast, later being recorded further east. Generally 10 to 20 per cent. of the plants were affected, but there were instances of 70 to 80 per cent. Insect transmission studies indicate a virus. Mechanical transmission has not been achieved, and under glasshouse conditions many plants recovered. The disease severely affects the grazing capacity of pastures, and, if it reduces or prevents flowering, large areas of the crop in New South Wales will go out of production.

Heavy attacks of *Uromyces striatus* [cf. 34, p. 373] at Taree and Wentworthville on burr medick (*Medicago denticulata*), a species hitherto resistant to this rust, constitute a new record for the State and indicate a possible new race of the fungus. Burn (*Sphaerulina trifolii*) [cf. 33, p. 358], reported on a small patch of burr medick at West Pennant Hills as attacking individual leaves, but not the plants as a whole, is also a new State record.

From the Citrus Experiment Station at Narara crinkle leaf virus is reported to be now established on the [lemon] variety Genoa in addition to the other varieties previously reported [35, p. 422]. Knobbly bark, a disease of unknown cause, has been found on the rough lemon stocks of mature orange trees in a number of orchards in the Pitt Town area. There were no outgrowths or apparent deleterious effects on the scions.

A disease believed to be green crinkle virus [31, p. 612] was observed on Granny Smith apples in two orchards at Uralla. In several cherry orchards at Orange symptoms resembling those of mottle leaf virus [20, p. 481] were observed on the varieties St. Margaret, Florence, and Napoleon.

Ray blight (*Ascochyta chrysanthemi*) of chrysanthemum was reported for the first time in the State at a flower farm in the West Pennant Hills, causing rotting of the petals and disk of the flowers and a certain amount of leaf blotching. Varietal differences were apparent. Leaf scorch (*Stagonospora curtisii*) of daffodil [*Narcissus*: cf. 33, p. 209] was reported from Southern Tableland. The disease is rarely found on daffodils in the State and its occurrence was thought to be due to very wet conditions.

Anthracnose (*Colletotrichum lindemuthianum*) [35, p. 354] and rust (*Uromyces phaseoli typica*) [*U. appendiculatus*: 35, p. 3] are now the most important bean [*Phaseolus vulgaris*] diseases in New South Wales. On the south coast the Vickery strain of the Brown Beauty bean variety has shown outstanding freedom from anthracnose, no infection having been recorded for three years.

Cauliflower leaves received from a seed producer at Dundas presented an autogenous, non-parasitic necrosis with numerous necrotic spots and ring spots, principally between the veins. The affected plants were from lines inbred over two generations, and the symptoms agreed in many respects with those described in the United States [33, p. 271]. The disease is attributed to recessive genes, concentrated by inbreeding. Molybdenum deficiency in parsnip, causing severe leaf mottling with islands of green tissue one to two mm. across surrounded by yellow tissue, and sometimes also necrotic spots, was reported for the first time in this crop, at Gosford.

The potato variety Crana showed high field susceptibility to early blight (*Alternaria solani*), many plants of some crops being practically defoliated.

Tomato spotted wilt virus was as usual widespread on tomatoes but once again of minor importance [35, p. 352] in areas where formerly losses of 50 to 100 per cent. were common in spring and early summer crops. The reason for the continuing decrease of incidence is unknown. An unidentified disease, possibly caused by tobacco yellow dwarf virus, is widespread round Sydney [cf. 35, p. 355], on the central coast, and to a lesser extent on the north coast, though as yet not recorded inland. Up to 100 per cent. infection was noted on some crops, and interference with fruit setting was greater than in past seasons.

Fruit rot (*Botrytis cinerea*) of blackberry was severe at West Pennant Hills in the wet late summer months. This disease has not been recorded before, though present for many years.

Miller (P. R.). **Plant disease situation in the United States.**—*F.A.O. Pl. Prot. Bull.*, 3, 10, pp. 148–151, 2 figs., 1955.

Under field conditions, particularly in bright summer weather, the symptoms of feathery mottle virus [*R.A.M.*, 34, p. 249] in Porto Rico Unit 1, Georgia Bunch, and Texas Bunch sweet potatoes become partially masked. Only in the shaded portions of the plant can definite symptoms be observed. A period of 39 to 45 days was required to develop symptoms in growth from infected roots. Wild and cultivated species of Convolvulaceae, many of them weeds in sweet-potato growing areas, have been shown to be susceptible [34, p. 175] and may prove to be important sources of spread if vectors are present.

In 1954 four specimens of *Aceria tulipae*, the vector of wheat streak mosaic virus [34, p. 588], were trapped 150 ft. above ground level at Manhattan, Riley County, Kansas, the nearest wheat fields being 1½ to 2 miles away.

In June 1954, *Phytophthora parasitica* attacked Black Diamond watermelons in the Lower Rio Grande Valley, Texas, causing a 15 per cent. loss of crop in some fields.

Preliminary studies at Beltsville, Maryland, indicated that the root-borer *Hylastinus obscurus* can act as a vector of the red clover anthracnose organisms *Colletotrichum trifolii* and *Kabatiella caulivora* [35, p. 159].

Wiltshire (S. P.). **Plant diseases in British Colonial Dependencies : a half-yearly report.**—*F.A.O. Pl. Prot. Bull.*, 4, 1, p. 11, 1955; 5, p. 66, 1956.

Diseases recorded from Malaya include a root disease of rubber caused by *Poria hypobrunnea*, tomato leaf spot due to *Diplodina* [*Didymella*] *lycopersici* [C.M.I. map No. 324], *Curvularia maculans* associated with a leaf die-back of young coconuts, *Nectria haematococca* with severe die-back of limes, and *Calonectria rigidiuscula* with stem rot of durian (*Durio zibethinus*). New host records from Malaya include *Fomes lignosus* on *Citrus microcarpa* and *Corticium salmonicolor* on calabash (*Crescentia cujete*).

*Mycosphaerella musicola* [No. 7] has been found in the conidial state on bananas in the Gold Coast and [British] Togoland, and is also reported from Montserrat.

Cotton rust (*Phakopsora desmium*) [No. 258] is reported from Agalega island, and specimens of maize rust (*Puccinia polysora*) [No. 237] have been received from North Borneo, and from Christmas Island, Indian Ocean.

In Nigeria *Helminthosporium turcicum* [No. 257] is serious on both rust-resistant and other varieties of maize; *Cochliobolus* [*Ophiobolus*] *miyabeanus* [No. 92] is common on rice. Banana wilt (*Fusarium oxysporum* f. *cubense*) [No. 31] is now considered to occur across the whole of Uganda.

Tarr (S. A. J.). **Diseases of economic crops in the Sudan. III. Fodders, pulses, and vegetables.**—*F.A.O. Pl. Prot. Bull.*, 3, 8, pp. 113–116, 1955.

In this concluding contribution of the series [cf. *R.A.M.*, 33, p. 759; 34, p. 137]

brief notes are given on a large number of diseases affecting fodders, pulses, crucifers, cucurbits, alliaceous vegetables, root vegetables, *Hibiscus esculentus*, tomatoes, and other vegetables in the Sudan.

In the Gezira *Dolichos lablab* is often heavily attacked by *Xanthomonas phaseoli* when grown in the rainy season; *Macrophomina phaseoli* is sometimes locally destructive on the same host grown under unfavourable environmental conditions. Lucerne is cultivated on a small scale, mostly in the northern part of the Sudan, and here rust (*Uromyces striatus*) [cf. 34, p. 549], powdery mildew (*Leveillula taurica*) [C.M.I. map No. 217], and sooty mould (mostly species of *Cladosporium* and *Alternaria*) sometimes cause appreciable damage.

In the wet extreme south cowpeas are often devastated by a zonate leaf spot the symptoms of which resemble those caused elsewhere by *Aristastoma oeconomicum* [cf. *R.A.M.*, 24, p. 353], but the Sudan pathogen has not yet been identified. Haricot beans (*Phaseolus vulgaris*) in the north are affected by a virus disease referred to locally as 'curly top', which occasionally causes almost complete crop failure. The leaves are reduced and cupped, the internodes are short, and the development of lateral shoots is stimulated, resulting in a stunted, bushy appearance. Severely infected plants become sterile. *U. appendiculatus* [C.M.I. map No. 290] often attacks haricot beans in the central and southern regions, causing considerable losses; the rust occurs also in the dry extreme north, infection presumably being facilitated by dew in winter.

On tomatoes *Cladosporium fulvum* and *Septoria lycopersici* are widespread and sometimes destructive in areas where the annual rainfall exceeds 20 in. Powdery mildew (*L. taurica*) is sometimes moderately severe on tomatoes [cf. *R.A.M.*, 32, p. 473] in the north.

**Pests and diseases of foodstuffs in store. Europe and Mediterranean 1953–1954.**—iii+23+xx+12+iii pp., European and Mediterranean Plant Protection Organisation, Paris, 1956. [French and English texts.]

This publication deals with the pests (insect and rodent) and fungus diseases of stored foodstuffs in Europe and the Mediterranean area during 1953–4. In the section on fungus diseases (pp. 15-18 in French and xiv–xvi in English) reference is made to losses of 3 to 10 per cent. of stored potatoes in Finland, 70 to 90 per cent. of which is due to *Phytophthora infestans*. Recommendations to reduce this include the cultivation of resistant varieties and temperature control at 3° to 5° C. in the storage cellars [*R.A.M.*, 34, p. 481]. Stored onions in Finland suffer serious loss from *Botrytis allii* [32, p. 57] and 40 to 50 per cent. of stored carrots are often lost, chiefly owing to *B. cinerea* and *Sclerotinia sclerotiorum*, but also to *Stemphylium radicinum* and *Fusarium avenaceum* [30, p. 301]. Losses of stored potatoes in Sweden due to *P. infestans* [35, p. 788] amount to 10 to 15 per cent. of the crop.

Briant (A. K.). **Annual report of the Department of Agriculture, Zanzibar Protectorate, 1955.**—31 pp., 1956.

In this report [cf. *R.A.M.*, 35, p. 164] it is stated (p. 11) that withertip [*Gloeosporium limetticola*: 34, p. 137] of limes remains a serious problem. A few seedling limes at Kizimbani showed marked resistance. As control of die-back [*Cryptosporella eugeniae*] of cloves continues the amount of re-treatment necessary decreases, and striking improvement is seen in trees severely diseased three or four years previously.

**Plant Diseases.**—*Rep. Colo. agric. Exp. Sta. 1952–53*, pp. 22–23, 2 figs, [? 1954. Received August, 1956.]

In brief notes of research on plant diseases in this report [cf. *R.A.M.*, 31, p. 104] it is stated that in a quick test for identifying potatoes resistant to scab [*Actino-*

*myces scabies*: 35, p. 539] a drop of 2 per cent. ferric chloride is placed on the scraped surface of a tuber. Resistant varieties produce a dark green coloration due to the presence of chlorogenic acid [35, p. 484].

Onion losses from purple blotch [*Alternaria porri*: 33, p. 333] were reduced by treatment with cuprocide and vancide 51. Some strains of *Fusarium* [*oxysporum* f.sp.] *cepae* [32, p. 580] were able to attack onions without prior damage by pink root [*Pyrenochaeta terrestris*].

Good control of *Rhizoctonia* root rot of bean [*Phaseolus vulgaris*: 35, p. 510] was achieved with ortho 406 [captan] and of bacterial blight [*Xanthomonas phaseoli*: 35, p. 503] by dusting with copper oxychloride. In varietal trials some Mexican bean varieties were highly resistant to *Fusarium* root rot [34, p. 568].

Pre-emergence damping-off in sugar beet [35, p. 142] seedlings was controlled by seed treatment with maneb, which was significantly better than the standard treatments. *Rhizoctonia* infection of sugar beet seedlings was not prevented by maintaining a high level of soil fertility.

Riker (A. J.) & Hildebrandt (A. C.). **Nutrition and diseased plant growths.**—*Symp. Biol., Brookhaven*, 6 (Abnormal and Pathological Plant Growth), pp. 79–95, 2 figs., 6 graphs, 1954. [Received May, 1956.]

Following a review of the extensive literature dealing with *Agrobacterium tumefaciens* [cf. *R.A.M.*, 35, pp. 513–514] and the influence of environment on host plant and disease development, metabolism of the bacterium in culture, and the growth of crown gall tissue on the host and *in vitro*, much of which has been noticed in this *Review*, the author discusses differences in metabolism between healthy and gall tissue.

Sterile crown gall tissue grew best at pH 5·5 to 6·5 and at 26° C.; this growth was inhibited by lyophilized crown gall bacteria or by media fermented by the bacteria. Growth was promoted by alanine, aspartic acid, and glutamic acid at 0·064 M but inhibited by the amino acids tested (except arginine) at 0·001 M. Tissue cultures from five plant species grew well on a number of sugars and polysaccharides; they tolerated many salts of organic acids or alcohols at pH 6 in the presence of sucrose, but not when these were the sole source of carbon. Responses to various carbon sources depended on the material and its concentration.

This subject has been dealt with elsewhere by the same authors (*Année biol.*, 30, 7–10, pp. 283–296, 1954).

Appel (O.), Blunck (H.), & Richter (H.). Ed. **Sorauer (P.). Handbuch der Pflanzenkrankheiten. Band II. Lieferung II. Bakterielle Krankheiten. Sechste Auflage.** [Handbook of plant diseases. Volume II. Part 2. Bacterial diseases. Sixth edition.]—viii+567 pp., 175 figs., 4 graphs, Berlin, Paul Parey, 1956. DM. 124.

In this new edition [cf. *R.A.M.*, 33, p. 580] the bacterial section [7, p. 733], revised by C. Stapp, has been expanded from 295 to 490 pages, whilst the streptomycoses are dealt with in a 58-page section at the end of this volume, in contrast to the 13-page supplement to the Fungi Imperfecti in the previous edition.

The treatment is unchanged, which is to say that the bacterial diseases are dealt with in the natural orders of the host plants as classified by Engler and Prantl, and for each disease a full description of the pathogen is given, the literature being cited at the end of each section. The bacterial nomenclature has been extensively revised and is now based, with few exceptions, on the sixth edition of Bergey's Manual (1948), and on the second of Elliott's 'Manual of bacterial plant pathogens' [31, p. 105]. Sixty-seven families of plants, including the Agaricaceae and Pucciniaceae, are now covered.

Sabet (K. A.). **Non-sporing bacteria responsible for soft-rots and related diseases of vegetables.**—Reprinted from *Proc. Egypt. Acad. Sci.*. 10 (*1954*). 5 pp.. 1955. [Received 1956.]

Investigations at Cairo University showed that a greenish soft rot of stored onions and a black soft rot of lettuce were caused by *Pseudomonas marginalis* [cf. *R.A.M.*. 34. p. 340]. A soft rot of cabbage in the field was induced by two different strains of *Bacterium carotovorum* [*Erwinia carotovora*]. and blackleg of potatoes by *B. carotovorum* var. *atrosepticum* [*E. atroseptica*: cf. 32. p. 448]. These observations constitute new records of the pathogens for Egypt. The optimum temperature for rot production was around 30° C. and the presence of free water was necessary for the development of a soft rot. a dry rot occurring in air at 100 per cent. relative humidity.

Desrosiers (R.). Von Buchwald (A.). & Bolaños (C. W.). **Selección en masa de plántulas de Cacao con base a su resistencia a la escoba de bruja.** [Mass selection of Cacao seedlings on the basis of their resistance to witches' broom.]—*Turrialba*. 5. 4. pp. 134–138. 1 graph. 1955. [English summary.]

In the course of rigorous mass selection of cacao seedlings for resistance to witches' broom (*Marasmius perniciosus*). which has been in progress since 1949 at the Tropical Experiment Station. Pichilingue. Ecuador [*R.A.M.*. 34. p. 22: 35. p. 663]. populations of the Venezuelan Trinitario type have proved superior in this respect to those of native origin. There were. however. considerable differences in resistance between individuals of the Trinitario populations. In one experiment. for instance. the percentages of survival. after two years of inoculation and elimination. were 13·8 and 11·8. respectively. for the red and yellow pod groups. compared with 0·7 for the native. In another test. covering one year only. the corresponding figures for red Trinitario. selected Trinitario (comprising a proportion of the progeny from trees of more than average resistance). and native were 17·1. 44·6. and 10·2, respectively.

Desrosiers (R.) & Von Buchwald (A.). **Fungicidal treatments for control of Cacao cutting disease in Ecuador.**—*F.A.O. Pl. Prot. Bull.*. 4. 2. pp. 17–21. 1 fig., 2 graphs, 1955.

Recent extensive propagation of cacao in Ecuador has been hampered by loss of cuttings in the propagators due to causes not precisely known [*R.A.M.*. 34. p. 22], although fungi. including *Diplodia* [*Botryodiplodia*] *theobromae*. appear to be implicated. Addition of fungicides to the water in which the cuttings are prepared has effectively increased rooting and reduced losses. Fermate and zerlate at 0·25 per cent. and dithane at 0·5 increased the percentage of plants developing four or more roots from 35·8 in the untreated to 68·3. 66·7. and 60 respectively. Spergon was less effective: formol and. more particularly. mercuric chloride were phytotoxic.

Desrosiers (R.). Von Buchwald (A.). & Bolaños (C.). **Effect of rainfall on the incidence of Monilia pod rot of Cacao in Ecuador.**—*F.A.O. Pl. Prot. Bull.*. 3, 11, pp. 161–164, 2 graphs, 1955.

Records made from 1951 to 1954 at the Tropical Experiment Station, Pichilingue. Ecuador. of the incidence of pod diseases occurring in the cacao crop harvested weekly showed a positive correlation between the incidence of *Monilia roreri* [cf. *R.A.M.*. 35. p. 359] and the amount of rain that fell during the fourth month preceding cropping. but none between the amount of disease present and rainfall during harvesting. This supports the view that infection by *M. roreri* takes place during the period of flowering and early fruit set, and indicates that protective

spraying begun with the rains and continued through this period should effectvely control the disease at the harvest peak.

As Trinitario cacao varies widely both in duration of harvest period and time of fruit set, it may be possible to make selections that will set fruit outside the period of serious infection.

Desrosiers (R.). **Thielaviopsis pod rot of Cacao in Ecuador.**—*F.A.O. Pl. Prot. Bull.*, 3, 10, pp. 154–155, 1 fig., 1955.

A pod rot of cacao caused by a species of *Thielaviopsis*, probably *T.* [*Ceratocystis*] *paradoxa* [cf. *R.A.M.*, 33, p. 593; 34, p. 354] was observed at the Tropical Experiment Station, Ecuador, in June, 1950, and has occurred on a few occasions since. Inoculation experiments demonstrated that the causal organism is a wound parasite which attacks only mature or almost mature pods. The disease is not of economic importance.

Orellana (R. G.). **Cacao diseases in Mexico, Nicaragua, Costa Rica and Jamaica.**—*F.A.O. Pl. Prot. Bull.*, 4, 3, pp. 35–37, 1955.

In a survey of the above-named countries [cf. *R.A.M.*, 33, p. 593] the writer found *Phytophthora* pod rot of cacao (*P. palmivora*) causing serious wet season losses in Mexico and to be prevalent in Nicaragua and Costa Rica, causing nearly 50 per cent. loss in the latter country [cf. 35, p. 753]. Losses occur in Jamaica in wet weather. Studies at Turrialba, Costa Rica, showed that different strains of *P. palmivora* attack cacao and rubber.

Anthracnose (*Colletotrichum gloeosporioides*) [*Glomerella cingulata*: loc. cit.] and thread blight (*Pellicularia* [*Corticium*] *koleroga*) [C.M.I. map No. 64] were common in all the areas visited. Horse-hair blight, attributed to *Marasmius trichorizus* [*M. equicrinis*], occurs in Costa Rica only and is of minor importance. Other diseases of interest noted include 'morte subita', observed only in Costa Rica, in which healthy trees die after a short period of wilting and leaf fall, with symptoms reminiscent of those caused by *Ceratostomella* spp. [cf. 33, p. 144].

In Costa Rica cuttings set in baskets made of abaca [*Musa textilis*] become infected with a *Marasmius* sp. [cf. 35, p. 171], probably *M. semiustus*. Buba or cushion gall [35, p. 663] has been seen occasionally in Costa Rica. A brooming effect in Jamaica [33, p. 590] was associated with a species of *Mycena*.

Henry (A. W.), Gilpatrick (J. D.), & Peterson (E. A.). **On the use of seed infected with the ergot fungus.**—Abs. in *Proc. Canad. phytopath. Soc.*, 23, p. 16, 1955.

In a replicated field test at Edmonton, Alberta, cereal grains infected with ergot [*Claviceps purpurea*: *R.A.M.*, 35, p. 157] were sown at depths ranging from 0 to three inches; no stromatic heads reached the soil surface from sclerotia more than one inch deep. Under soil conditions in Alberta sclerotia sown in the autumn are more likely to germinate and provide inoculum than those sown in the spring, but it is quite safe to use infested seed of perennial grasses and cereals if the seeding depth is sufficient.

Hashioka (Y.). **Field fungicidal control of the cereal diseases.**—*Agric. & Hort., Tokyo*, 30, 1, pp. 182–186, 3 figs., 1955. [Japanese, with English summary.]

The information concerning the control of *Puccinia triticina* on wheat, *P. hordei* on barley and *Erysiphe graminis* on cereals in Japan has already been noticed [*R.A.M.*, 35, p. 94]. Ceresan, diluted with slaked lime 1 to 5, effectively controls head scab (*Gibberella zeae*) [34, p. 222] and, if applied at early tillering, also foot rot (*Corticium gramineum*) [32, p. 325]. Lime-sulphur applied during winter at early tillering and dichlone control leaf scald (*Rhynchosporium secalis*).

Pichler (F.). **Zur Frage der Warmwasserbehandlung des Saatgutes bei der Flugbrandbekämpfung. II. Mitteilung.** [On the question of hot water treatment of seed in loose smut control. Note II.]—*PflSchBer.*, 17, 1–2, pp. 1–26, 1 fig., 2 graphs, 1956.

In further studies on the physiology of wheat and barley during warm water treatment [*R.A.M.*, 33, p. 343] the author found that at 45° C. the oxygen content of the water fell rapidly, inducing anaerobic respiration, which began sooner, was more intense, and also persisted longer during drying in barley than in wheat, explaining the greater effectiveness of the treatment for the former. Alcohol and acetaldehyde were demonstrated quantitatively in the grain at the end of the bath treatment and during drying.

Salt (G. A.). **Effects of nitrogen applied at different dates, and of other cultural treatments on eyespot, lodging and yield of winter Wheat. Field experiment 1952.**—*J. agric. Sci.*, 46, 4, pp. 407–416, 1 pl., 8 graphs, 1955.

Most of the results of these experiments at Rothamsted on the effect of manurial treatment on eyespot (*Cercosporella herpotrichoides*) of wheat have already been noticed [*R.A.M.*, 33, p. 76; cf. 35, p. 152]. Comparison with other experiments [31, p. 279] indicated that the effect of nitrogen in increasing eyespot at harvest was most marked on soils of low fertility. There appears to be no particularly favourable period for applying nitrogen, but weather is a major factor affecting the response in yield to the applications [see above, p. 872].

Burger (W. C.). **Purification and stability of the yellow streak mosaic virus of Wheat.**—*Phytopathology*, 46, 4, pp. 236–237, 1956.

At the Nebraska Agricultural Experiment Station preparations of the type culture of wheat yellow streak mosaic virus [*R.A.M.*, 33, p. 22], obtained from expressed sap of inoculated wheat plants by two to four cycles of differential centrifugation in distilled water at 3,000 G for 30 minutes and 79,000 G for one hour, were found to be non-infective. After a single cycle of centrifugation the virus remained infective for a short time but by the end of 16 hours in distilled water at 4° C. it had become inactive, in marked contrast to freshly expressed sap from diseased plants, which was still infective after a fortnight at the same temperature. The results of infectivity assays on Michigan Amber wheat plants in the trifoliate stage indicated that virulence is retained for only a few hours after sedimentation by centrifugation and that inactivation ensues during the time required for further purification in the absence of stabilizing substances present in the plant sap.

In experiments to preserve infectivity in the semi-purified virus, measured volumes of dilute solutions of glycerol, glucose, sucrose, and gelatin, previously adjusted to pH 5·5, were added to freshly purified preparations and the mixtures held at 4° for 20 hours prior to assay. The solutions containing 0·1 per cent. gelatin retained about 80 per cent. of the infectivity of the freshly purified material in distilled water, the corresponding figures for glycerol, glucose, and sucrose being 70, 60, and 60 per cent., respectively. It is suggested on the basis of these data that the use of the non-antigenic gelatin may prove valuable in the purification and storage of the wheat streak mosaic viruses for serological purposes [cf. 33, p. 285].

Hagborg (W. A. F.). **The effect of antibiotics on infection of Wheat by Xanthomonas translucens.**—*Canad. J. Microbiol.*, 2, 2, pp. 80–86, 2 figs., 1956.

At the Plant Pathology Laboratory, Winnipeg, Manitoba, Thatcher wheat seedlings were grown in plastic plexiglass culture vessels containing Shive's four-salt solution with added trace elements. Various concentrations of single antibiotics were added to the culture solution, and their effects observed on infection of

the wheat by *Xanthomonas translucens* [*R.A.M.*, 25, p. 389; 32, p. 239]. Resistance of the seedlings to the pathogen was increased by streptomycin and chloramphenicol [cf. 33, p. 545], but not by actidione, griseofulvin [34, p. 802], or neomycin. All the antibiotics tested reduced the dry weight of the seedlings, neomycin the least and streptomycin the most. In another series of experiments agar cultures of *X. translucens* were inhibited by streptomycin and chloramphenicol, but not by the other antibiotics. It is concluded that the resistance to *X. translucens* induced in the wheat plant by the two antibiotics is directly attributable to their presence, unchanged, in the cell sap and the sensitivity of the pathogen to them, rather than to the production of antibodies.

Hagborg (W. A. F.). **Heat tolerance of host and parasite in false stripe of Barley.** —Abs. in *Proc. Canad. phytopath. Soc.*, 23, pp. 15–16, 1955.

In further studies on barley false stripe virus [*R.A.M.*, 33, p. 665] the thermal inactivation point in infective juice was found to be 64·1° C., which was higher than the thermal death point of barley seed in water (60°). When barley seed was heated in carbon tetrachloride at 76·8° for two hours more than 50 per cent. of the germinability was retained but the virus was not inactivated.

Slykhuis (J. T.). **Sources of inhibitors of Barley false stripe virus infection.**—Abs. in *Proc. Canad. phytopath. Soc.*, 23, p. 21, 1955.

Symptoms of barley false stripe virus on barley [see preceding abstract] were completely inhibited by treatment of virus-infected sap with 1 in 20 concentrations of sap from leaves of *Capsicum frutescens*, *Chenopodium album*, and *Monolepis nuttalliana*, while partial inhibition was caused by potato, *Fragaria* sp., and *Salsola pestifer* sap. Inhibition of barley false stripe virus and wheat streak mosaic virus on both wheat and barley was caused by skim milk and sap from *Capsicum frutescens* and *Fragaria* sp. At a dilution of 1 in 200, sap of *C. frutescens* markedly inhibited barley false stripe virus but the effect of milk declined when diluted to 1 in 40 or more. Filtrates from 25 per cent. of a number of fungi also caused strong inhibition of the virus.

Levine (M. N.) & Cherewick (W. J.). **Greenhouse and fieldplot studies on varietal reactions to Barley leaf rust.**—*Canad. J. agric. Sci.*, 36, 2, pp. 127–143, 1956.

In greenhouse and field experiments at St. Paul, Minnesota, and Winnipeg, Manitoba, from 1935 to 1954, inclusive, a total of 324 barley varieties and selections were tested in the seedling stage for resistance to all the races of dwarf leaf rust (*Puccinia hordei*) [*R.A.M.*, 34, p. 31] so far isolated from North American collections, with the exception of races 41 and 42, but including race 50. Of the varieties tested, 99 were immune from or moderately resistant to each of the races used, while 122 showed resistance to some and susceptibility to others. Of the 100 varieties tested for adult plant reaction in uniform rust observation nurseries in the United States during the past 20 years the following were consistently resistant: Abyssinian, Bolivia, Chilean, Luth, Morocco, Nameless, and Quinn. During the four years of the experiment at Winnipeg (1944–47), of the 234 adult varieties and selections subjected to artificially induced epidemics 36 never exceeded an average of 2·5 per cent. (trace) infection. Varieties showing resistance in the seedling stage remained resistant as adults, but some susceptible seedlings became resistant as they matured.

As a result of these studies the authors suggest that high resistance could be transferred to varieties of barley agronomically suited to regions with frequent rust epidemics; that on account of the probable presence in the rust fungus of numerous biotypes the development of resistant varieties is more difficult, but that genes for resistance to which the pathogen is not readily adaptable may be present

in varieties showing resistance both as seedlings and adults; and that the breakdown in resistance of some hitherto resistant varieties may be due to a number of factors, such as a virulent and aggressive physiologic race or races becoming prevalent after being rare.

Wratt (E. C.). **Diseases in New Zealand Oat crops.**—*N.Z. J. Sci. Tech.*, Sect. A, 37, 6, pp. 526–534, 2 figs., 1956.

At Canterbury Agricultural College, Lincoln, New Zealand, 12 local oat crops and 77 oat seed samples from the South Island were examined for disease incidence. Among the pre-emergence diseases *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, 26, p. 232] caused uneven crop growth, while bare or thin patches of seedlings occurred in soil infested with *Fusarium avenaceum* [29, p. 15]. Seedling leaf blotch (*Helminthosporium* [*Pyrenophora*] *avenae*) [cf. 15, p. 565] affected all the lines of Algerian oat seed examined. *Puccinia* spp. were predominant on maturing crops, *P. coronata* [34, p. 212] becoming aggressive when daily maximum temperatures consistently exceeded 60° F. Halo blight (*Pseudomonas coronafaciens*) [18, p. 389] was prevalent on Garton's Onward and Russet for 30 days in October and November. Small, red leaf spots appearing on Algerian in mid-summer are stated to be due to *Ascochyta avenae* which is regarded as a synonym of *Septoria graminum* [7, p. 224]. Powdery mildew (*Erysiphe graminis*) [17, p. 20] was absent from the 12 local crops. Loose smut (*Ustilago avenae*) [loc. cit.] affected 50 per cent. of Garton's Onward and Dun sowings but only 3 per cent. of Algerian, with 7 per cent. or less smut in any one sowing. Covered smut (*U. kolleri*) [loc. cit.] affected the Dun variety alone, the heaviest infection resulting in 4·3 per cent. smutted heads.

The importance of seed disinfection for protection against smuts, *F. avenaceum* and *Pyrenophora avenae*, is emphasized.

Jacks (H.) & Cruickshank (I. A. M.). **Seed disinfection. XIII. The effect of fungicidal seed treatments on emergence and covered-smut (Ustilago kolleri Wille) of Oats.**—*N.Z. J. Sci. Tech.*, Sect. A, 38, 1, pp. 27–29, 1956.

In further studies in this series [cf. *R.A.M.*, 35, p. 730] by the Plant Diseases Division, Auckland, New Zealand, nine seed treatments were tested in two field trials from 1952 to 1954, inclusive, against covered smut (*Ustilago kolleri*) [see preceding abstract], using inoculated seed of the oat varieties Onward, Abundance, and Milford. Of the organic mercury compounds tested, all at 2 oz. per bush., granosan M, panogen, and verisan completely eliminated the disease, while ceresan, agrosan GN, and agranin, and to a lesser extent leytosan and agrimax M significantly reduced it from 37·6 untreated in 1953, and 5·3 in 1954, a wetter year, to a range of 0 to 4·6 per cent. Hexachlorobenzene (anticarie SD) was not as effective as the mercurials. Only granosan M significantly reduced emergence (from 72·2 and 78·8 per cent. for the two years, respectively, to 68·4 and 56·2 per cent.) under wet soil conditions. Under conditions favourable to smut Milford was more susceptible than Onward or Abundance.

Turner (Elizabeth M.). **A fungicide produced by Oats, and its relation to resistance of Oats to take-all.**—Abs. in *Ann. appl. Biol.*, 44, 1, p. 200, 1956.

At the Department of Botany, Oxford, a thermostable, methanol-soluble substance, obtained in a partially purified state from sap expressed from the leaves of oat seedlings, when used at a concentration of 3·3 to 4 μgm. per ml. reduced the growth of *Ophiobolus graminis* and *O. graminis* var. *avenae* in synthetic medium to 50 per cent. of that of the controls. Used at a concentration of 55 μgm. per ml., it reduced the respiration rate of these fungi by the same proportion. The toxicity of the substance was nullified by adding glutathione or ascorbic acid to the medium.

Phycomycetes, ascomycetes, and basidiomycetes were sensitive to 10 μgm. per

ml. of the substance, but not any of the fungi imperfecti tested. *O. graminis* var. *avenae* grows in the sap from oat roots, but *O. graminis* is killed.

Sabet (K. A.). **The effects of streptomycin and terramycin, singly and in combination, on the leaf blight disease of Maize caused by Bacterium carotovorum f. zeae Sabet.**—*Ann. appl. Biol.*, 44, 1, pp. 152–160, 3 graphs, 1956.

At the Department of Agricultural Botany, University of Cairo, the growth *in vitro* of *Bacterium* [*Erwinia*] *carotovora* f. [sp.] *zeae* [*R.A.M.*, 33, p. 477] was inhibited by streptomycin (dihydrostreptomycin sulphate) and by terramycin. Joint application gave a synergistic action, most apparent at the 1:1 ratio, and the mixture effectively checked the development of resistant strains of the organism which rapidly appeared after treatment with streptomycin alone.

Roots of G102 maize seedlings in water cultures and leaves of older, potted plants readily absorbed both antibiotics, the leaves more especially with a high water content of the soil. Absorption from leaf applications at first increased with higher concentration of the antibiotics and more frequent spraying, but after eight daily applications of streptomycin symptoms of toxicity appeared and there was evidence that the antibiotic was inactivated.

Treatment of the leaves by spraying or rubbing with either antibiotic or the 1:1 mixture shortly before inoculation with the organism reduced the incidence and severity of leaf blight, but no appreciable effect was noted when the plants were treated two days after inoculation. Terramycin was in most cases more effective than streptomycin. The movement of the antibiotics in the leaves was at first both downwards and upwards, as demonstrated by infection-free areas at the edges of sites treated when inoculating the terminal and proximal ends. Later, movement appeared to occur in an upward direction only, and that of terramycin was slower than of streptomycin. The results of inoculations made five days after antibiotic treatment indicated that the effect of the streptomycin was declining, while that of the terramycin was increasing. The diffusion and movement of the antibiotics in the 1:1 combination were intermediate between those of the components separately and there was a noticeable synergistic effect. Antibiotic treatment of the leaves did not induce resistance to infection in the stems and roots.

Gorter (G. J. M. A.). **Outbreaks and new records. Bechuanaland Protectorate. Union of South Africa.**—*F.A.O. Pl. Prot. Bull.*, 4, 5, p. 72, 1956.

In June, 1955, *Ramulispora sorghi* [*R.A.M.*, 33, p. 599] was first recorded in the Bechuanaland Protectorate on kaffir corn (*Sorghum caffrorum*), on which it was widespread; it also infected Columbus grass (*S. almum*). *Sclerospora sorghi* [C.M.I. map No. 179] and *Puccinia purpurea* [No. 212], too, were found on *Sorghum almum*, in the Northern and Eastern Transvaal respectively, new records for this host in South Africa.

Schneider (H.). **A new disorder of Eureka Lemon trees.**—*Calif. Citrogr.*, 41, 11, p. 387, 1 fig., 1956.

The author reports a new disease of Eureka lemon trees on sweet orange rootstocks, characterized by extensive necrosis of the sieve-tubes of the stock, below the bud union. Evidence indicated that the rootstocks were not gametic seedlings. Affected trees were stunted, new growth suppressed, the foliage yellow, and the branches partially defoliated. Trees were affected in entirety, and not on one side only. The condition was seen in scattered trees (amounting to about 1 per cent.) in two blocks in Ventura County, planted in 1948 and 1949, and may be of importance as sweet orange is the most successful citrus rootstock for lemons, but further work is needed to clarify the nature of the disease.

Reference is made to two other conditions: lemon sieve-tube necrosis [*R.A.M.*,

35, p. 365] affecting Eureka lemon on all rootstocks, and sour orange rootstock necrosis [loc. cit.], affecting the sieve-tubes of some lemon strains on sour orange rootstocks.

Da Matta (E. A. F.) & Da Silva (M. E.). **A 'tristeza dos Citrus' na Bahia.** ['Citrus tristeza' in Bahia.] Reprinted from *Bol. Inst. biol. Bahia*, 1, 1, 23 pp., 5 figs., 1955.

Following a summary of the available information on the history, geographical distribution, symptomatology, etiology, and modes of transmission of citrus tristeza, the authors discuss the situation prevailing in Bahia, Brazil [cf. *R.A.M.*, 35, p. 179], where the effects of the virosis began to be experienced about 1945. The application of the iodine test [23, p. 484] to a total of 667 trees, including 574 of sweet orange on sour orange stocks, yielded a high proportion of positive results (575 or 81·7 per cent.). Moreover, the disease is on the increase, both in the capital and in the interior. Control measures should be based on the use of resistant scion-stock combinations and the extermination of the vector, *Aphis tavaresi* [*A. citricidus*].

Dickson (R. C.), Johnson (Metta McD.), Flock (R. A.), & Laird (E. F.). **Flying aphid populations in southern California Citrus groves and their relation to the transmission of the tristeza virus.** *Phytopathology*, 46, 4, pp. 204–210, 1 graph, 1956.

During the period from 1951 to 1954 the green citrus or spiraea aphid (*Aphis spiraecola*) constituted about 85 per cent. of the flying aphid populations trapped on sticky boards in southern California. Only 3 per cent. consisted of the cotton or melon aphid (*A. gossypii*), but the 35,000 of the latter species recorded as flying to each orange tree each year in the area of the most rapid spread of tristeza (quick decline) virus more than sufficed to account for the spread of the disease, even though the transfer of an average of 5,600 individuals was required to produce each infection in tests at the Citrus Experiment Station, Riverside. In the groves the number of new infections seldom exceeded two per annum from each diseased tree.

The virus was shown to be non-persistent in its vector and to be carried locally only by *A. gossypii*, at any rate at a demonstrable level of efficiency.

Moreira (S.). **Exocortis disease and Rangpur Lime rootstock.** *Calif. Citrogr.*, 41, 8, p. 320, 4 figs., 1956.

This is a summary of a paper already noticed in this *Review* [*R.A.M.*, 35, p. 180]. An additional note states that the University of California Citrus Experiment Station as yet lack experimental evidence to confirm the author's identification of Rangpur lime disease with exocortis.

**Spray recommendations for California Citrus 1956.** *Calif. Citrogr.*, 41, 9, p. 352, 1956.

This note draws attention to the publication of the '1956 Spray Program for California Citrus Fruits' from the University of California Citrus Experiment Station. A table recording the compatibility of citrus spray materials is reproduced.

**New method for preventing fruit decay.** *Calif. Citrogr.*, 41, 8, p. 288, 1956.

The Citrus Experiment Station, University of California, has developed a mixture of chemicals which releases ammonia gas [*R.A.M.*, 35, p. 13] in the presence of moisture, and which is considered superior to diphenyl for the prevention of mould on citrus fruit in transit. The mixture can be varied to provide the appropriate amount of ammonia under specific conditions of moisture and can be used in the form of pellets or of impregnated paper for lining cases, the latter seemingly being preferable.

Rodney (D. R.), Harding (R. B.), Boswell (S. B.), & Whiting (F. L.). **Lemon tree collapse as related to sodium in roots.**—*Calif. Citrogr.*, 41, 8, pp. 313-315, 317, 1 graph, 1956.

Following a comparison of the sodium content of the roots of 36 Cascade Eureka lemon trees when all were healthy, and again when some had collapsed [*R.A.M.*, 34, p. 640], the authors conclude that a high sodium content is the result and not the cause of this condition. It is suggested that the low carbohydrate level in the roots, due to sieve-tube necrosis near the bud union, alters either the permeability of the root cells or some other mechanism controlling the absorption or exclusion of sodium.

Samson (J. A.). **Handleiding voor de Citruscultuur in Suriname.** [Manual of instruction for Citrus cultivation in Surinam.]—*Meded. LandbProefsta., Suriname*, 19, 77 pp., 6 figs., 1956.

Information on citrus diseases and their control in Surinam is summarized in popular terms on pp. 48–56 of this manual. Damping-off is caused by *Rhizoctonia* [*Corticium solani*: *R.A.M.*, 32, p. 68] and *Phytophthora* spp. Sour oranges and limes are highly susceptible to scab (*Elsinoe fawcetti*) [loc. cit.], grapefruit and King orange less so, and sweet oranges practically immune.

Areolate leaf spot (*C. areolatum*) [or *C. solani*: 23, p. 315] is another disease favoured by humid conditions, sour oranges and grapefruit being particularly susceptible, followed by shaddock and King orange, while sweet oranges are fairly resistant. Copper sprays should be applied to the young shoots and to the fallen leaves on the ground.

Gummosis of the stem and branches does not appear to be caused primarily by *Phytophthora* sp. under local conditions, but extensive fungal growth occurs round the periphery of the gum spots, especially in a cool, damp environment. Sweet orange and grapefruit are more susceptible than lime and citron, while the sour orange is practically immune. Control should be based on strict sanitation, with special attention to drainage, and the excision of all lesions, the surface being treated with a wound dressing, e.g., Socony [Vacuum product] 2295A, and the debris burnt or buried deeply. Occasionally the roots may be involved, in which case the gum exudate is replaced by a blue-black discoloration. As a rule this type of decay is soon followed by the death of the tree; on eradication the root system should be burnt.

A *P.* sp. is responsible for brown rot of the fruits, which may be combated by stringent hygiene in the plantations. Infection may also develop in storage and in suspicious cases the fruits should be washed in a 1·5 per cent. soda solution.

Stem-end rot (*Diplodia natalensis*) is apt to cause very heavy damage to stored fruit and especially during transit abroad. Spraying in the plantation is of little use and the fruits should be treated before storage or shipment with dowicide A. Green mould (*Penicillium digitatum*) is another source of spoilage in stored fruits. Blue mould (*P. italicum*) is of rare occurrence in Surinam.

In connexion with the occurrence of citrus tristeza virus [C.M.I. map No. 289] in Argentina, Brazil, Colombia [*R.A.M.*, 34, p. 296], and possibly Venezuela, and the recent detection in Surinam of its most efficient vector, *Toxoptera* [*Aphis*] *citricidus*, the author emphasizes the importance of its exclusion by absolutely prohibiting the importation of grafting wood. A resistant rootstock to replace the sour orange should be energetically sought.

Wahlberg (H. E.). **Citrus growing in Thailand.**—*Calif. Citrogr.*, 41, 8, pp. 286, 300–302, 8 figs., 1956.

In a short account of citrus cultivation in Thailand, where it is handicapped by primitive methods of propagation and agriculture and lack of fertility, especially

of minor elements, the writer mentions the general occurrence on the trees of sooty mould and felt [unspecified], of lichens in the south and central areas, brown rot gummosis and foot rot [*Phytophthora* spp.] in the north, and a small amount of psorosis [virus].

Grangier (A.) & Wellman (F. L.). **Algunos fungicidas usados con adherentes en aspersiones para cafetos jóvenes.** [Some fungicides used with stickers in sprays for Coffee nurseries.] —*Turrialba*, 5, 4, pp. 123–131, 1 graph, 1955. [English summary.]

Of the 12 spray treatments tested for the control of *Cercospora coffeicola* and *Colletotrichum coffeanum* [*Glomerella cingulata*] in a Bourbon coffee (*Coffea arabica*) nursery at Turrialba, Costa Rica [*R.A.M.*, 33, p. 712; 35, p. 14], nine applications being given between 27th June and 28th November, 1953, the most successful was a solution of 2 lb. fermate plus 1 pint PEPS sticker [cf. 33, p. 527] in 100 gals. water. The number of healthy leaves on 15 treated plants (average of four plots) was 102·3 compared with 23·9 on the controls. Next in order of efficiency came fermate (2 lb.) alone (70), the figures for perenox [35, p. 824] (2·3 lb.) plus PEPS, fermate (2 lb.) plus 1 pint RDA–156 (a synthetic oil of petroleum manufactured by the Standard Oil Development Company) [loc. cit.], crag 658 plus PEPS, and the same plus RDA–156 being 62·3, 57, 55, and 52, respectively. Captan (4 lb.), even with the addition of stickers, was unsatisfactory, but in later trials its performance was much improved by the addition of 1 pint RDA-156-B10 (containing 10 per cent. triton B-1956) or 15 lb. urea or both, and did not, in fact, differ significantly from that of fermate. With both additives and applied at three- to four-weekly intervals (total of five applications) it gave effective control of the two pathogens, the urea also counteracting the adverse effects on nitrogen deficiency in the nursery soil. The plants in the untreated plots were severely defoliated by the fungi.

Lochrie (J. V.), Spence (J. R.), & Cave (C. T.). **West Indies, Cotton Experiment Stations. Progress Report for the season 1954–55.**—*Progr. Rep. Exp. Stas Emp. Cott. Gr. Corp.* (*West Indies*), *1954–5*, 22 pp., 1956.

In the section of this report dealing with cotton pests and diseases (pp. 18–20) it is stated that in 1954–5 bacterial blight [*Xanthomonas malvacearum*] in both its angular leaf spot and blackarm forms was severe on the young crop in Antigua, seedling death being recorded in some instances. In St. Kitts and Montserrat, owing to the rainy conditions that prevailed while the crop was maturing, there was a high incidence of black boll (*Phytophthora* sp.) [*R.A.M.*, 17, p. 455], and considerable losses resulted.

Revilla (V. A.). **Occurrence of bacterial blight of Cotton in Peru.**—*F.A.O. Pl. Prot. Bull.*, 4, 4, p. 55, 1956.

Bacterial blight [blackarm] of cotton (*Xanthomonas malvacearum*) is reported for the first time in Peru [C.M.I. map No. 57], in the Chira and Piura Valleys, where it has become well established.

Arnold (M. H.). **Diseases.**—*Progr. Rep. Exp. Stas Emp. Cott. Gr. Corp.* (*Tanganyika Territory, Lake Province*), *1954–5*, pp. 14–21, 1956.

In a further trial in Tanganyika in 1954–5, treatment of cotton seed against *Xanthomonas malvacearum* [*R.A.M.*, 35, pp. 367, 677] with perenox, perecot 45, and agrosan GN 5 (each at 1:300 w./w.) gave, respectively, 2·7, 3·9, and 0·6 per cent. cotyledonary infection and 1, 2·6, and 0·3 per cent. vascular infection, the corresponding figures for the untreated being 46 and 17·4 per cent. In a second trial the corresponding figures were 7, 4·8, and 0·3; 3·8, 2, and 0·2; and 70·9 and 47·9 per cent.

The spread of infection from plot to plot was investigated in a block of land where cotton had not been grown for four years, divided into 56 plots 30 ft. square and sown with acid-delinted seed, that sown in the two central plots having been inoculated with *X. malvacearum*, and the remainder treated with agrosan GN5. At 77 days after emergence counts of spots indicated gradients of infection radiating from the central focus of the disease. At 94 days the position was complicated by the presence of 'peaks' of infection which could not easily be related to the over-all gradient. The leaf infection present at these two stages did not develop into more serious forms of the disease, and it did not appear that the plots adjacent to the infection focus had any greater loss of crop than the more remote plots. The plots sown with disinfected seed gave a mean increase in yield over the two central plots of 12 per cent.

Other observations indicated that a plant infected at a later stage of growth, either from trash or as a result of spread from a neighbour, has a better chance of compensating for the damage than one infected at the cotyledonary node from the seed.

Wickens (G. M.). **Vascular infection of Cotton by Xanthomonas malvacearum (E. F. Smith) Dowson.**—*Ann. appl. Biol.*, 44, 1, pp. 129–137, 1 pl., 1956.

At the Cotton Research Station, Namulonge, Uganda, cotton seedlings raised under glass from seed pre-soaked in a water suspension of *Xanthomonas malvacearum* [cf. *R.A.M.*, 35, p. 524 and preceding abstract] and watered only by sub-irrigation developed atypical, dull green, flaccid areas extending from the margin of the cotyledons. Later symptoms included vascular discoloration, not always continuous, in the petioles of affected cotyledons, in the hypocotyl, and in parts of the epicotyl; premature withering of the cotyledons; dull green, flaccid areas in the true leaves, later turning brown and drying, usually with a chlorotic margin; and infection of the parenchyma in the stems, petioles, and leaves.

The evidence obtained from observations of the progress of the symptoms and from isolations of *X. malvacearum* from different parts of the plant clearly demonstrated that the course of this type of infection is primarily vascular, progressing from the cotyledon margins into the hypocotyl and thence upwards. Infection may break out at any time in the parenchyma, with the resultant development of the more characteristic forms of the disease. Similar symptoms were also observed in the field.

These observations show conclusively that severe stem disease and death of young cotton plants can occur in the absence of rainfall and be caused by movement of *X. malvacearum* within the plant. There is strong indication that this may be at least partly responsible for the severe early main stem lesions that commonly occur in Uganda.

Borisov (G.). Результаты испытания новых сортов Хлопчатника. [Results of a trial with new Cotton varieties.]—Хлопководство [*Cotton Raising*], 6, 8, pp. 33–38, 5 figs., 1956.

A number of new cotton varieties are reported from the U.S.S.R. The early variety KK–1543 is stated to be resistant to [unspecified] wilt [cf. *R.A.M.*, 34, p. 299] and gummosis [blackarm: *Xanthomonas malvacearum*: 34, p. 523] and is recommended for the northern and central regions of the Kara-Kalpak S.S.R. to replace KK-602 and KK-351 which do not mature early enough. More resistant to *X. malvacearum* than the regional variety 5476–I of Iolotan, Turkmen Republic, is 8763–I.

Laird (M.). **A new species of Coelomomyces (fungi) from Tasmanian Mosquito larvae.**—*J. Parasit.*, 42, 1, pp. 53–55, 5 figs., 1956.

An English diagnosis is given of *Coelomomyces tasmaniensis* n.sp., found

parasitizing larvae of *Aëdes australis* [cf. *R.A.M.*, 26, p. 488] near Port Davey, Tasmania, in 1954.

The sporangia are elongate-oval, with one face strongly convex and the others flat or concave, 79·3 to 109·5 $\mu$ by 36·5 to 56·5 $\mu$, with a wall of two layers, the inner smooth and hyaline, 0·6 $\mu$ in thickness, the outer golden-brown, four or five times thicker, reticulated in surface view and pierced by numerous round or oval pits, imparting a striated appearance in sectional view.

FLOR (H. H.). **Identification of races of Flax rust by lines with single rust-conditioning genes.**—*Tech. Bull. U.S. Dep. Agric.* 1087, 25 pp., 3 figs., 1954. [Received June, 1956.]

A new key for race determination in *Melampsora lini* is proposed, based on the reaction of 18 flax lines (16 the same as before [*R.A.M.*, 26, p. 489] with the addition of Victory A and Stewart), each apparently carrying a single rust-conditioning gene, and made possible by the gene for gene relationship between host reaction and pathogenicity [*R.A.M.*, 35, p. 526]. The lines were selected on the grounds of sharp reaction differences, resistance to North American races of *M. lini*, value as sources of resistance in breeding, and efficiency in differentiating North American races. This bulletin reviews previous literature and sets out the principles and practices employed in developing the newly devised system of identification of races.

DIMOND (A. E.) & STODDARD (E. M.). **Toxicity to greenhouse Roses from paints containing mercury fungicides.**—*Bull. Conn. agric. Exp. Sta.* 595, 19 pp., 1 fig., 1955.

At the Connecticut Agricultural Experiment Station the greenhouse roses Better Times, Briarcliff, and related varieties were subjected to mercury vapour released from paints containing di-(phenylmercuric) dodecenyl succinate (DPMDS). The flowers of affected plants are off-colour, young buds fail to open, and bud scales turn brown. The liberation of mercury vapour was almost eliminated by applying 5 parts of dry lime-sulphur in a paste of 10 parts wheat flour and 100 parts water over the paint. This treatment remained effective for five months in one commercial house. Roses once affected may continue so for some time, even after removal from a contaminated environment. There is some evidence that the mercury can be taken up through the soil, which must be replaced.

FRY (P. R.) & HUNTER (J. A.). **Rose-mosaic virus in New Zealand.**—*N.Z. J. Sci. Tech.*, Sect. A, 37, 6, pp. 478–482, 4 figs., 1956.

A description is given of rose mosaic virus disease [cf. *R.A.M.*, 32, p. 314] which is reported to be present throughout New Zealand in two distinct symptom forms, veinbanding and line pattern. The former occurs either in isolated areas of the leaflet, in a strip round the margin, or throughout the entire vein network; the latter may be in spots or blotches or extend across the leaflet in a zigzag. Veinbanding has been observed on Mme A. Meillard (Peace), Texas Centennial, Charlotte Armstrong, Shot Silk, and Cecile Brunner; line pattern on Majorca, Pinocchio, and Mrs. O. G. Orphan. The two forms were transmitted by budding, each retaining its identity on the new host, indicating that they are caused by distinct virus entities.

MILLER (P. R.). **Virus diseases of Gladiolus in the United States.**—*F.A.O. Pl. Prot. Bull.*, 3, 8, pp. 122–124, 1955.

Most of the information in this paper concerning virus diseases of gladiolus in Oregon has already been noticed from another source [*R.A.M.*, 34, p. 368 *et passim*].

Parmelee (J. A.). **The occurrence of Curvularia on Gladiolus in Canada.** Abs. in *Proc. Canad. phytopath. Soc.*, 23, pp. 18–19, 1955.

Recent morphological studies on the *Curvularia* isolated from gladiolus in Montreal [*R.A.M.*, 34, p. 94] indicated that it was nearer *C. trifolii* than *C. lunata*.

Isaac (I.). **Some soil factors affecting Verticillium wilt of Antirrhinum.** *Ann. appl. Biol.*, 44, 1, pp. 105–112, 1956.

The results of earlier investigations into the influence of soil conditions upon *Verticillium* wilt of numerous hosts [cf. *R.A.M.*, 33, p. 545] are reviewed and it is pointed out that the connexion between both the water-content of soil and the effect of liming (and pH) on the pathogenicity of *Verticillium* is very obscure, and though it is generally agreed that a rise in soil nitrogen increases the incidence of these diseases, there are contrary reports on this and other fertilizer effects. The author shows that the apparently conflicting conclusions reached may be due to the fact that many plant pathologists include all pathogenic strains of the genus in *V. albo-atrum*, while others separate them.

Experiments were carried out at University College, Swansea, to determine the effects of five different pathogenic strains of *Verticillium* on *Antirrhinum majus* plants [loc. cit.] grown in John Innes compost subjected to different fertilizer treatments. By altering the chemical balance of the compost and varying the water supply 20 different treatments were prepared.

The evidence obtained demonstrated that *V. albo-atrum*, *V. dahliae*, *V. nigrescens*, *V. nubilum*, and *V. tricorpus* differ in pathogenicity to antirrhinum, and that their infectivity may be affected by soil treatments. In pot cultures the incidence of wilt due to *V. dahliae* or *V. nigrescens* was reduced by increasing potassium or ammonium sulphate or by decreasing soil moisture. *V. nubilum* and *V. tricorpus* caused wilting only under waterlogged conditions and with heavy dressings of hoof-and-horn. *V. albo-atrum* was the most virulent species tested and its pathogenicity could not be reduced by any of the soil treatments used. Other fertilizer changes appeared to have no effect on the virulence of any of the species.

These results support the author's earlier conclusion that these five pathogenic strains of *Verticillium* must be regarded as separate entities [29, p. 333]. Therefore, the exact identity of a species being investigated must be known. Results must be judged by the total number of plants wilted rather than by symptoms, which are similar regardless of the species involved.

Moreau (Mireille). **Déséquilibre de la microflore fongique du sol dans les cultures d'Œillets méditerranéennes.** [Disequilibrium of the soil fungal microflora in Mediterranean Carnation culture.]—*C. R. Acad. Agric. Fr.*, 42, 11, pp. 557–559, 1956.

Studies of the soil microflora of carnation gardens of different ages at Saint Roman du Bellet and Nice-Ventabrun, France [*R.A.M.*, 32, p. 562], showed that the cultivation of carnations, with the attendant bringing of subsoil to the surface, suppressed the saprophytic microflora even in as short a time as two years and encouraged successive invasion by *Fusarium roseum*, *F. oxysporum*, *Alternaria dianthi*, *Rhizoctonia* [*Corticium*] *solani*, *Phytophthora cactorum*, and *Phialophora* [*Verticillium*] *cinerescens* [35, p. 767], all being finally present and capable of survival even if the growing of carnations is suspended for a few months. Rigorous plant hygiene and the raising of the humus status of the soil is recommended.

Darpoux (H.). **La maladie de l'ergot des Graminées.** [Ergot disease of the Gramineae.]—*Rev. Path. gén. comp.*, 55, 673, pp. 1479–1510, 5 figs., 1955.

In this study the author, after briefly describing the salient features of ergot disease of the Gramineae caused by *Claviceps purpurea* [cf. *R.A.M.*, 34, p. 225; 35, p. 489, *et passim*] and reviewing the history of earlier investigations, presents a

full account, based on the literature (95 references), of the biology of the fungus, including the germination of the sclerotia, perithecial formation, ascospore release, dissemination, and germination, primary infection, ergot development, the formation of conidia of the *Sphacelia* type, conidial dissemination, conidial infection, and the formation, dissemination, and conservation of the sclerotia. A section is devoted to specialization in *C. purpurea*, and another to factors predisposing hosts to infection or tending to reduce it. Other points dealt with are the losses caused by the disease, its control, the culture of the fungus on artificial media, and the production of ergots on rye ears by artificial inoculation.

**A report on Fusarium patch disease.**—*Parks*, 21, 11, pp. 710, 713, 1956.

This information on the effect of different rates of application of ammonium sulphate on the development of *Fusarium* patch disease [*Calonectria nivalis*] on turf and its control with griseofulvin has already been noticed from another source [*R.A.M.*, 35, p. 771].

Couch (H. B.) & Cole (H.). **Five compounds tested for control of Merion Bluegrass rust.**—*Plant Dis. Reptr*, 40, 2, pp. 103–105, 1956.

An epiphytotic of rust (*Puccinia graminis*) on Merion bluegrass (*Poa pratensis*) [*R.A.M.*, 35, p. 460] occurred in Pennsylvania in 1955. Kentucky bluegrass adjacent to the Merion plantings remained healthy. A measure of control was obtained at the Department of Botany and Plant Pathology, Pennsylvania State University, University Park, by two applications at 15-day intervals of actidione (422 or 844 mg. in 2 gals. water per 1,000 sq. ft.), 2 or 4 oz. of dithane D-14 plus zinc sulphate plus copper sulphate or dithane D-14 plus zinc sulphate, captan 50-W (2·5 or 5 lb.), and Mathieson 1456 (20 gm.). Actidione and the dithane-zinc-copper formulation were the most satisfactory, reducing the disease rating from 1·8 (untreated) to 0·4 and 0·8, respectively, at the higher rates of application, but the fact that they are phytotoxic prevents their immediate recommendation for general use on this variety.

Newman (R. J.). **Plant nutrient deficiencies in Victorian pasture soils.**—*J. Agric., Vict.* (formerly *J. Dep. Agric. Vict.*), 54, 8, pp. 337–345, 7 figs., 2 maps, 1956.

Much of this information on mineral deficiencies in the pasture soils of Victoria has already been noticed from other sources [*R.A.M.*, 32, p. 563; 35, p. 233]. Recent pasture trials conducted by the Department of Agriculture showed that most Victorian soils are deficient in phosphorus, while in a series of trials at 56 centres in 1953 most soils with long established pastures and good response to superphosphate were found to contain sufficient trace elements. Of the trace element deficiencies, that of molybdenum is regarded as the most widespread. Copper deficiency in subterranean clover [*Trifolium subterraneum*: 33, p. 300] is corrected by copper sulphate dressings (7 lb. per acre) at intervals of six to eight years.

Vestad (R.). **Kløverråte (Sclerotinia trifoliorum Erikss.) på Rødkløver i Norge.** [Clover rot (*Sclerotinia trifoliorum* Erikss.) on Red Clover in Norway.]—*Forsk. Fors. Landbr.*, 6, 5, pp. 359–378, 1955. [English summary.]

Little importance was attached to clover rot (*Sclerotinia trifoliorum*) in Norway before 1948, but studies carried out since that date [*R.A.M.*, 33, p. 299] have revealed its prevalence in a severe form in the east and south of the country. Outbreaks have also been recorded in the west and in Trøndelag, though these regions have not been so thoroughly explored; no observations on the disease have been made in the north. The fungus has also been detected occasionally on alsike and white clovers and lucerne.

In the course of breeding operations performed at the Institute of Genetics, Agricultural College of Norway, from 1952 to 1954, using Frandsen's method of

inoculation [27, p. 365], significant differences in resistance were demonstrated between the various native strains and families tested. The Swedish Merkur and the Danish semi-late Resistant III, which are reasonably resistant in their own countries [18, p. 684 and loc. cit.], did not appear specially promising in these trials. The performance of the tetraploid families was satisfactory both in the field and in inoculation tests, but no significant difference between them and the diploid group in respect of resistance to rot has yet been established.

KLINKOWSKI (M.). **Chlorophylldefekte des Luzerneblattes, unter besonderer Berücksichtigung des Luzernemosaikvirus (Marmor medicaginis Holmes).** [Chlorophyll defects of the Lucerne leaf, with special reference to the Lucerne mosaic virus (*Marmor medicaginis* Holmes).]—*Phytopath. Z.*, 26, 4, pp. 377–400, 15 figs., 1956.

During 1938–9 lucerne material consisting principally of an international assortment of varieties and lines, some supplied by the Commonwealth Bureau of Plant Breeding, Aberystwyth, was examined for virus disease at the Biological Institute, Berlin-Dahlem. There are stated to be few well-documented references to lucerne viroses in Germany, and only recently has Hein (in the press) recorded the occurrence of the mosaic virus [*R.A.M.*, 9, p. 120] on a number of weeds.

The thermal death point of the virus in sap was found to lie between 62° and 65° C. [cf. 13, p. 489], and the dilution end point above 1 in 2,048 [cf. 17, p. 721], while the survival period *in vitro* extended over more than three but less than five days [loc. cit.]. Inoculated mechanically into Samsun Bashi bagli tobacco leaves, lucerne mosaic virus first induced a pale spotting of the interveinal areas, followed by the formation of small, light brown necroses and occasionally by the development of a 'quercina' [oak-leaf] pattern. Beans (*Phaseolus vulgaris*) inoculated with sap from tobacco plants displaying this pattern reacted by the development of predominantly large, chocolate-brown necroses, whereas the Dahlem strain induced the formation of characteristically small ones after three to four days. Thus, the total numbers of large foliar necroses on five plants of each of five varieties resulting from inoculation with the oak-leaf and Dahlem strains were 42·6 and 26·7, respectively, and the corresponding figures for small ones 17·8 and 176·4. Negative results were obtained in inoculation tests on bean with infective material from the same host, and attempts to transmit the virus to *P. multiflorus* were also unsuccessful.

The first symptoms on the primary leaves of *Datura stramonium*, developing after seven days, were isolated, circular, pale, desiccated spots, followed in another week by mosaic-like clearings and later by light brown necroses on the successive leaves.

Typical symptoms appeared after 18 days on white lupin foliage inoculated by needle punctures on the leaves and slitting of the stem. Grey-green, sunken spots were formed on the lamina, to be replaced after a further 11 days by pale yellow to brownish necroses, delimited by a reddish-brown margin. Subsequently the affected leaves wilted. The youngest leaves of two out of nine yellow lupin plants developed chlorotic spots, while blue lupins had contracted no symptoms within two months of inoculation.

Three weeks after the inoculation of broad bean leaves, abraded with carborundum and slightly diluted sap, punctiform, chlorotic areas appeared on isolated leaf blades; attempts at re-transmission to tobacco gave negative results. Soy-bean leaves similarly inoculated responded by clearings, especially along the veins, after 11 days. The large, reddish-brown discolorations induced by lucerne mosaic virus in three days on the leaf blades of *Vicia villosa* were particularly striking. On *V. angustifolia* and *V. lutea* brown necroses were formed two months after inoculation.

It is concluded that the infections examined were of lucerne mosaic virus. Brief

descriptions are also given of several types of symptoms which were definitely proved by transmission tests to be of virus origin but could not be more closely identified under the circumstances.

Cormack (M. W.) & Moffatt (J. E.). **Seed transmission of bacterial wilt of Alfalfa.** —Abs. in *Proc. Canad. phytopath. Soc.*, 23, p. 15, 1955.

In experiments at the Science Service Laboratory, Lethbridge, Alberta, seed from lucerne plants severely infected by bacterial wilt [*Corynebacterium insidiosum*: *R.A.M.*, 35, p. 157] transmitted the disease when surface-sterilized and used as inoculum for healthy plants in the greenhouse. *C. insidiosum* was transmitted to a greater extent by shrivelled, discoloured seed than by sound; cleaned seed from moderately infected plants in the field produced no infection.

When sections of infected seed were stained by a modified Gram technique, the bacteria were observed in intercellular spaces of the parenchyma; they were also very abundant in the vascular tissues of pedicels and pods.

**Growing Alfalfa for seed.**—*Circ. Utah agric. Exp. Sta.* 135, 60 pp., 54 figs., 6 graphs, 1 map, 1955.

The diseases of lucerne in Utah dealt with on pp. 19–22 of this circular include bacterial wilt (*Corynebacterium insidiosum*) [*R.A.M.*, 34, p. 791 *et passim*], bacterial stem blight (*Pseudomonas medicaginis*) [28, p. 577], yellow leaf blotch (*Pseudopeziza jonesii*) [34, p. 459], downy mildew (*Peronospora trifoliorum*) [34, p. 438], crown wart (*Urophlyctis alfalfae*) [28, p. 577], witches' broom virus [32, p. 564], and white spot, a physiological disturbance occurring when rain or irrigation succeeds a dry period, the leaf lesions ranging from necrotic flecks to large white spots.

Millikan (C. R.). **Diseases of turf.**—*J. Agric., Vict.* (formerly *J. Dep. Agric. Vict.*), 54, 8, pp. 397–400, 5 figs., 1956.

In Victoria *Marasmius oreades* is the fungus most frequently associated with fairy rings in turf, but *Lycoperdon furfuraceum* may sometimes occur. Other turf diseases include dollar spot (*Sclerotinia homoeocarpa*) [*R.A.M.*, 35, p. 356], brown patch (associated with *Corticium solani* [loc. cit.], *Helminthosporium* sp., *Curvularia* sp., and *Fusarium culmorum*), pink patch (*Corticium fuciforme*) [cf. 35, p. 192], and *Fusarium* patch caused by several *F.* spp.

**1956 spray recommendations for tree fruits in eastern Washington.**—*Ext. Bull. St. Coll. Wash.* 419 (revised), 35 pp., 10 figs., 1956.

This bulletin has again been revised [cf. *R.A.M.*, 35, p. 613]. A table on p. 33 sets out the rates of spray application per acre by bulk, semi-concentrate, and concentrate methods for different spacings of the trees.

Goidànich (G.), Govi (G.), & Branzanti (E. C.). **Le virosi delle piante da frutto in Emilia e Romagna.** [The virus diseases of fruit trees in Emilia and Romagna.] —*Ital. agric.*, 91, 8, pp. 603–606, 15 figs., 1954.

Brief notes (with 19 references to the literature) are given in semi-popular terms on the following virus diseases and disorders possibly of virus origin affecting fruit trees in Emilia and the Romagna, Italy: peach rosette mosaic [cf. *R.A.M.*, 34, p. 792], ring spot [cf. 35, p. 106], dwarfing and angular discoloration (two conditions thought to be of virus origin), and non-infectious variegation (a disorder characterized by pale green to white areas on the leaf blade and likely to be confused with a virus disease); almond mosaic [34, p. 792]; apple mosaic [35, p. 372] and 'plastomania'; and fig mosaic [34, p. 735]. 'Plastomania', in which the woody parts are deformed owing to the presence of spiral-shaped depressions and the virus origin of which has been demonstrated, is somewhat widely present, mostly on Abbon-

danza, Gravenstein, and Rambour franco apples. It usually appears when the trees are two or three years old and persists during almost their whole life. Cropping is somewhat reduced and the branches break readily.

Bartels (Gerda). **Über einige Fragen der Pathogenität, des Krankheitsverlaufes und der chemotherapeutischen Bekämpfungsmöglichkeiten von Sclerotinia fructigena Schroet. und Sclerotinia laxa Aderh. u. Ruhl.** [On some questions of the pathogenicity, course of the disease, and possibilities of chemotherapeutic control of *Sclerotinia fructigena* Schroet. and *Sclerotinia laxa* Aderh. & Ruhl.]—*Wiss. Z. Univ. Rostock*, 4 (*1954–1955*), 3, pp. 357–380, 16 figs., 6 graphs, [undated, received 1956].

The material used in these extensive studies on brown rot of pip and stone fruits, which is stated to be greatly on the increase in North Germany, was collected in Mecklenburg and Brandenburg in 1951–2, isolates of *Sclerotinia laxa* being obtained from Morello cherry, plum, and apple, and of *S. fructigena* from apple, pear, and plum. The cultures were maintained on beer wort agar, cherry juice agar, and oatmeal, each medium serving for alternate periods of three months.

The results of blossom inoculation experiments demonstrated a strong tendency to specialization. True, both species caused a brown discoloration of the stigma and style in all the trees, but in general, further development of the mycelium, culminating in wither tip, was restricted to isolates of *S. laxa* from the same host. Similar observations were made in branch inoculation tests, which were successful only when conidia dispersed in gelatin were used to secure adhesion. Mechanical injuries were essential for fruit infection. In contrast to the blossoms and branches, the inoculated fruits yielded no clue to the species used except in the structure and colour of the conidial 'cushions', those of *S. laxa* being grey and flimsy while those of *S. fructigena* were ochre-yellow and coarse.

The conidia of *S. laxa* were shown to be much more vigorous and long-lived than those of *S. fructigena*, the former still germinating to the extent of 10·4 per cent. in 166-day old cultures, in which the latter were totally extinct. The superior vitality of *S. laxa* was also manifested by its uniformly higher viability at both constant and falling temperatures. In the spring, therefore, it enjoys a clear-cut advantage over *S. fructigena* in already possessing large numbers of old as well as newly-formed conidia, which have still to be produced by the latter species from over-wintered mycelium.

In the author's experiments *S. fructigena* produced concentric zones of conidia only in cultures maintained under natural alternations of light and darkness. A reduction in the hours of light resulted in decreased zonation, while in cultures kept in darkness mycelial development was copious with only a single zone of conidia in the centre. The optimum temperature for mycelial development in both species is about 25° C., at which point and at 20° the absolute growth of *S. fructigena* is much heavier than that of *S. laxa*. The minimum and maximum for both species were below 2° and over 30°, respectively.

In *in vitro* tests on beer wort or water agar the mycelial growth of both pathogens was inhibited by an admixture of cupral at 1·8, abavit at 0·9, germisan at 1, and debena at 0·1 per cent. In preliminary outdoor trials cupral, abavit, and germisan were effective against blossom rot of Altenländer Pfannkuchen apples and debena against fruit decay of Emma Leppermann plums.

Cinq-Mars (L.) & Crête (R.). **The effectiveness of four fungicides against Apple scab and their various effects on the trees. (Results of four years' experiments).** —Abs. in *Proc. Canad. phytopath. Soc.*, 23, p. 15, 1955.

Results from comparative fungicide trials for the control of apple scab [*Venturia inaequalis*] from 1950 to 1953, inclusive, at Rougement, Quebec [*R.A.M.*, 34,

p. 135] with magnetic 70 [sulphur], mulsoid, ferbam, and glyodin are briefly summarized. Glyodin was consistently superior as a foliage protectant against scab while ferbam gave fairly good results on fruit. Ferbam-sprayed trees had bigger buds and longer shoots than the other treatments, followed by glyodin, mulsoid, and magnetic 70, while the last-named gave fewer and smaller apples.

Kirkham (D. S.) & Flood (A. E.). **Inhibition of Venturia spp. by analogues of host metabolites.**—*Nature, Lond.*, 178, 4530, pp. 422–423, 1956.

In further studies at East Malling Research Station on substances inhibitory to *Venturia inaequalis* and *V. pirina* [*R.A.M.*, 33, p. 432] a search was made for a phenolic compound of the chlorogenic acid type which would be more toxic to the pathogens and less to the host. Of seven structural analogues, including chlorogenic acid, tested *in vitro*, only cinnamic acid prevented both growth and germination of the two pathogens.

Cox's Orange Pippin apple shoots, grown in artificial light in the greenhouse, were inoculated with *V. inaequalis* and injected after 24 hours with a 0·2 per cent. solution of sodium cinnamate. The treated shoots displayed only a slight interveinal chlorosis and reduction in growth and thirteen days after inoculation infection was still inhibited to a high degree. The persistence of the cinnamate in leaves above the point of injection was confirmed by chromatography.

Neumann (P.). **Probleme und Erfahrungen im Obstschorfwarndienst.** [Problems and observations in the fruit scab warning service.]—*Pflanzenschutz*, 8, 6, pp. 76–84, 12 figs., 2 graphs, 1956.

Well-known information on the biology of the apple scab fungus (*Venturia inaequalis*) is presented in semi-popular terms in this explanatory account of the functions of the spray warning service, with special reference to Bavarian conditions.

Săvulescu (A.), Bontea (V.), Hulea (A.), Beceréscu (D.), Marin (A.), Șuta (V.), & Piersică (E.). **Einfluß der klimatischen Bedingungen auf die Bildung, das Auftreten und die Reifung der Perithecien von Endostigme inaequalis (Cooke) Sydow und auf das Ausschleudern der Ascosporen.** [Influence of climatic conditions on the formation, appearance, and maturation of the perithecia of *Endostigme inaequalis* (Cooke) Sydow and on the ejection of the ascospores.]—*Phytopath. Z.*, 26, 4, pp. 333–376, 8 graphs, 1 map, 1956.

This is an important contribution to the understanding of the influence of climatic conditions on the biology of the apple scab fungus, *Endostigme* [*Venturia*] *inaequalis* [C.M.I. map No. 120 and preceding and next abstracts], based on recent studies covering four consecutive years in various fruit-growing regions of Rumania. The perithecial state, first observed in the country in 1945 (*Agricultura*, 1, pp. 13–18, 1946), is now widespread in the leading areas of fruit production. The several stages in the development and maturation of the perithecia were shown by observations from 1951 to 1954, inclusive, to occur at much lower temperatures than any hitherto recorded, i.e., at a monthly mean of −7·5° C., a mean minimum of −12°, and a mean maximum of −2° in January, 1954 [cf. *R.A.M.*, 7, p. 451, *et passim*]. Persistence for one to two months of mean temperatures down to −3°, mean minima of −6°, and mean maxima of 5° did not preclude normal perithecial development in January and February. Low precipitation retards and reduces perithecial production, as for instance, at one of the experiment stations in 1952–3, when only 28 mm. rain fell on 12 days distributed over a period of two months. The perithecia did not become visible before mid-December at the earliest (15th on 11 out of 33 varieties at one station in 1952); on the following 15th January they were detected on a further 20, and on 15th February on the slightly susceptible Ontario. In the winter of 1953–4, the first perithecia appeared on Gelber Edelapfel

on 25th December; on 25th February they were seen on Rheinischer Bohn, Canada Pippin, and Kalterer Böhmer, while on 25th March and 25th April they were noted on 14 and 11 varieties, respectively. Perithecia-bearing leaves were numerous on the Belle fleur jaune, Jonathan, and Crețesc varieties and very few on Boiken, Cox's Orange Pippin, and Crețesc roșu de Vîlcea, the three last-named being among the least susceptible. The bulk of the perithecia, which constitute an important source of spring inoculum, are formed on fallen leaves between the end of August and the end of October.

Like the perithecia, the ascospores also mature at different dates, generally within the period from 1st March to 15th April. Thus, for purposes of prognosis and the spray warning service intensive studies on ascospore ripening should begin on the earlier date. This process usually occurs at higher temperatures than those requisite for perithecial formation and appearance, i.e., mean maxima of 1° to 12° for a month, means between 1° and 6°, and mean minima for a brief period between −3° and −5°. The temperature relations normally prevailing during January, February, and early March in the Rumanian fruit-growing districts afford favourable conditions for the accumulation of a substantial supply of ripe ascospores. Maturity can even be attained when the mean temperatures fluctuate between 8° and 15°. However, ripening of the ascospores is delayed by low rainfall (e.g., less than 20 mm. after the appearance of the perithecia) even when temperatures are propitious. Under normal environmental conditions the duration of ascospore ripening in an orchard is from 45 to 50 days.

Ejection of the ascospores usually begins during April [cf. 16, p. 685 *et passim*] and continues for a period of 21 to 53 days, with two to five main spore flights. Liberation is generally initiated shortly after the wetting of the leaves and during the next 30 to 40 minutes most of the ascospores are expelled to a distance of between 3 and 7 mm. Heavy rain retards the process. Any delay in the perithecial appearance and ascospore ripening and ejection increases the risk of severe infection of the young organs of the host. Conversely, the earlier the foregoing processes occur, the greater is the number of abortive spores, since at this period the trees are in a phenological phase unfavourable to infection. Moderate winds promote the flight of the ascospores to the top of the crown, on the leaves of which fewer were trapped than on those of the middle and lower sections. The apple scab conidia and ascospores may be carried by the wind in a horizontal direction for distances of up to 300 m. from the source of infection.

For the purpose of spraying-date predictions field observations must be supplemented by studies in the laboratory, where ascospore germination takes place a few days earlier than in the orchard on account of the higher temperature. The prognosis regarding the development and maturation of the perithecia can be made during the months of January to March, inclusive. In the forecasting of spraying dates it is essential to consider not only the onset of infection, but more especially the reserve of ripe ascospores, the amount of rainfall, and the phenological phases of the host.

Săvulescu (A.), Bontea (V.), Hulea (A.), Becerescu (D.), Marin (A.), Șuta (V.), & Piersică (E.). **Contribuții la stabilirea eficacității diferitelor substanțe și preparate în combaterea bolii 'pătarea cafenie și rapănul' la Meri (Endostigme inaequalis (Cooke) Syd.).** [Contribution to the determination of the efficacy of different substances and products in the control of the 'coffee spot and scab' disease of Apple (*Endostigme inaequalis* (Cooke) Syd.).]—*Comun. Acad. Repub. pop. rom.*, 6, 5, pp. 973–984, 1955. [Russian and French summaries.]

The experiments herein reported from four stations of the Rumanian Institute of Agronomic Studies covered the period from 1950 to 1954 and were concerned with three important aspects of the chemical control of apple scab (*Endostigme* [*Venturia*]

*inaequalis*) [see preceding abstract]. In the first two years two or three treatments were given according to the standard schedule, while in the later ones five or six were applied in accordance with spray warnings based on the biology of the pathogen.

Dormant treatments did not exert a decisive influence on the control of the disease. Although 2 per cent. Bordeaux mixture was slightly more effective than emulsifying oil (5 or 6 per cent.), the latter is to be preferred on account of its insecticidal properties. A schedule comprising a dormant treatment with highly concentrated (5 per cent.) Bordeaux ('blue mixture'), followed by only two later applications proved less successful than a weaker one (2 per cent.) in the winter and four or five during the growing season. Better results were given at this time by the use of the mixture at 0·75 to 1 than at 0·5 per cent., but the lower strength is recommended on account of the damage caused by the higher concentration, especially on the Jonathan variety, including leaf scorch and malformation and reticular suberization of the fruits. The fungicidal action of Bordeaux, especially at the lower strength, was enhanced by the incorporation of 0·25 per cent. penetrol [*R.A.M.*, 23, p. 389].

None of the sulphur products tested, e.g., lime-sulphur, wettable sulphur, and cosan, conferred adequate protection against scab.

Kearns (H. G. H.), Marsh (R. W.), & Morgan (N. G.). **Spray application problems: XXVII. Field experiments in the control of Apple and Pear scab by small-volume sprays, 1955.**—*Rep. agric. hort. Res. Sta. Bristol. 1955*, pp. 136–139 [1956].

Continuing this series of studies at Long Ashton Research Station, Bristol [*R.A.M.*, 35, p. 684], small-volume air-flow sprays of lime-sulphur and captan were tested in the field in 1955. Six applications of either 2 or 4 per cent. lime-sulphur or 0·1 per cent. captan at 55 gals. per acre per application resulted in unsatisfactory control of apple scab [*Venturia inaequalis*] on 30-year-old bush trees of Cox and Worcester with heads some 20 ft. in diameter.

On the other hand, six applications of 0·1 per cent. captan (30 gals. per acre) gave excellent control of pear scab [*V. pirina*] on William's pears grown in a modified 'hedgerow' system and having heads about 5 ft. in diameter, and similarly, 1 per cent. lime-sulphur, though less effective at 30 gals. per acre than at 80 or 250, even at the lowest rate gave good control on pear compared with untreated trees. The more suitable conformation of the pear trees for the small-volume spray application may account for the much better results obtained with them than with the apples.

Byrde (R. J. W.), Clarke (G. M.), & Harper (C. W.). **Spraying experiments against Apple scab at Long Ashton, 1955.**—*Rep. agric. hort. Res. Sta. Bristol. 1955*, pp. 140–145 [1956].

In the second year of the three-year trial at Long Ashton for the control of apple scab (*Venturia inaequalis*) [see preceding abstract], in the dry summer of 1955, post-blossom applications of captan (0·075 per cent.) or lime-sulphur (0·75), following pre-blossom lime-sulphur sprays (2 or 1 per cent.), gave excellent control (less than 0·04 per cent. fruit area scabbed) on Cox's Orange Pippin. Substituting captan for lime-sulphur in the post-blossom spray tended towards a heavier crop with less fruit russet. Mildew (*Podosphaera leucotricha*) was markedly less in evidence on shoots of the current season's growth on the plot receiving lime-sulphur alone both in 1954 and 1955 but the attack on the other plots was not of economic importance. Apparently much of the shoot infection was confined to the leaves.

Sprague (R.). **A re-study of Apple powdery mildew in eastern Washington.**—*Bull. Wash. St. Dep. Agric.* 560, 36 pp., 12 graphs, 1955.

Apple mildew [*Podosphaera leucotricha*: *R.A.M.*, 35, p. 614 *et passim*] was wide-

spread in Washington State between 1949 and 1953. Infection of Delicious was extensive but light, the resistant Winesap showed appreciable injury, and Jonathan and Rome were particularly susceptible. After a severe winter that kills twigs and buds the carry-over of the disease is light; otherwise, if unchecked, mildew is plentiful by early summer. Sprinkler irrigation favours the disease and overhead sprinklers are to be avoided. Details are given of extensive spray trials, spraying schedules are discussed, and suggested schedules tabulated. Of many chemicals tested for control only sulphur compounds and karathane proved satisfactory.

Vanwetswinkel (G.). **Witziekte op Appel.** [Apple mildew.]—*Cult. en Hand.*, **22**, 3, pp. 57–59; 6, pp. 150–151, 1956.

Essential information is presented in popular terms on the symptoms and life-history of apple mildew [*Podosphaera leucotricha*] and its control in Holland [*R.A.M.*, 35, p. 830]. An initial application of wettable sulphur should be given at the onset of a warm, dry spell in May or June and repeated ten days later if similar conditions persist, using a product with particles about 5 mμ in diameter at a dosage of or exceeding 500 l. per ha. Of great importance as an adjunct to spraying is the timely excision of diseased shoots.

Brian (P. W.), Elson (G. W.), & Lowe (D.). **Production of patulin in Apple fruits by Penicillium expansum.**—*Nature, Lond.*, **178**, 4527, pp. 263–264, 1956.

At Imperial Chemical Industries, Ltd., Akers Research Laboratories, Welwyn, Herts., a strain of *Penicillium expansum* which produced patulin in culture [*R.A.M.*, 33, p. 573] also produced the antibiotic when inoculated into apple fruits, concentrations of up to 1,000 mgm. per l. being detected by bioassay in sap from rotted tissue of Bramley's Seedling. Sap from natural rots caused by *P. expansum* often contained patulin. Strains which produced no detectable patulin caused equally severe rotting.

Edney (K. L.). **The rotting of Apples by Gloeosporium perennans Zeller & Childs.**—*Ann. appl. Biol.*, **44**, 1, pp. 113–128, 1 pl., 1 graph, 1956.

During investigations on the rotting of stored apples by *Gloeosporium* [*Neofabraea*] *perennans* and *G. album* [cf. *R.A.M.*, 35, p. 685 and above, p. 873], conducted at the Ditton Laboratory, Department of Scientific and Industrial Research, Kent, it was ascertained that where losses of Cox's Orange Pippin fruit had reached 10 per cent. tree infections were readily found, mostly of the nature of die-back following pruning cuts and cankers following aphis injury; in no instance had attack begun with the penetration of undamaged bark. *G. album* was much less prevalent than *N. perennans*, and was generally growing saprophytically on dead wood, though very occasionally it was parasitic on healthy tissue. It is also encountered on cankers due to *Nectria galligena* and, rarely, on infections of *Neofabraea perennans*.

Most of the commercial Cox crop is grown on bush trees pruned in autumn and winter, and in some cases a substantial number of the pruning cuts were found to be infected by *N. perennans*; many made in December, 1953, when the fungus was actively sporing, were observed to be infected in the early spring of 1954. Detached leaves of Cox's Orange Pippin were successfully inoculated with *N. perennans* in the laboratory, and the fungus was also found on dead leaves in the orchard after picking.

Marked variations were observed in the susceptibility to rot of samples of different varieties of apples. In 1953, nine weeks after samples of fruit had been loaded with spores and stored at 50° F., Cox's, Bramley's Seedling, Sunset, and Tydeman's Late Orange varieties had, respectively, 94, 100, 100, and 16 per cent. rot: in 1954, the corresponding figures after six weeks' storage were 98, 8, 80, and 74 per cent. Thus, seasonal variations in susceptibility to attack were in some instances

greater than the inter-varietal differences for any one year, Tydeman's Late Orange displaying this difference most conspicuously. There was no evidence that Cox is consistently more susceptible to attack than other varieties, but it shows a wide variation in susceptibility in different localities. Apparently Bramley's Seedling suffers severely from attack only when the sample is particularly susceptible or infection is unusually severe. Periodic loading of fruit with spores after picking showed that resistance to lenticel rotting declines with increasing duration of storage, and wide variation in the time at which rotting begins in commercially stored samples was noted. When spore loading of Cox's apples was effected on 21st October, 2nd November, 2nd December, 3rd January, and 2nd February and the fruit was stored at 50°, the number of weeks required for 100 per cent. rotting to develop was, respectively, 10, 10, 9, 6, and 4. Inoculations of picked and unpicked immature fruits demonstrated that the apple loses its resistance to attack on picking. Lenticels closed to gaseous exchange were shown to resist penetration by the fungus. Lenticel rotting, most rapid at about 20° C., still takes place quite extensively at 5°, and to some extent at 0°.

Though rotting by *N. perennans* is generally considered to be a storage disorder, it is probable that its control will require measures to reduce spore production in the orchard [see following abstracts] and to increase the resistance of the fruit, in addition to improved storage practice.

Hamer (P. S.) & Hunnam (D.). **Three captan sprays reduce Gloeosporium.**—*Grower*, **46**, 4, pp. 205, 207, 1956.

Field trials were carried out at Kirdford during 1955 to ascertain the best times for the application of captan sprays to Cox's Orange Pippin apple trees for the control of *Gloeosporium* [*Neofabraea perennans*: see preceding and next abstracts] rot in store. The incidence of rot was considerably reduced by three sprays of captan (2 lb. per 100 gals.) applied in late July, late August, and early September. One spray in July had no effect on the rot. This extensive use of captan did not aggravate physiological breakdown of the apples in storage.

**Storing Cox : advice on spraying against rot.**—*Grower*, **46**, 4, p. 292, 1956.

In this article, issued jointly by the Ditton Laboratory, East Malling Research Station, and Long Ashton Research Station, the necessity for protective sprays against storage rots of Cox's Orange Pippin apples caused by *Gloeosporium* [*Neofabraea perennans*: see preceding abstracts] is emphasized. The application of 0·1 per cent. captan just before a rainy period is recommended, early September being the best time as infections during this period probably cause the earliest losses in store. Susceptibility to rots and breakdown in store is increased by heavy nitrogenous fertilizing.

Clark (P. G.) & Hey (G. L.). **Cox spot makes a strong new attack.**—*Grower*, 44, 5, pp. 222–223, 2 figs., 1955.

The term Cox spot has been applied to the appearance of brown, dead areas, circular or irregular in outline, on the leaves of Cox's Orange Pippin apples. The disorder has been observed for ten years or more but was especially marked in 1955, when the spots developed in early June, on the oldest leaves, which sometimes dropped. The cause of the condition remains unknown; it was apparently not induced by spray treatment, and post-blossom sulphur sprays reduced it. A rather similar blotching was noticed on Allington Pippin, Bramley, Laxton's Superb, and Warner's King apples and on Doyenne du Comice pears.

Yarwood (C. E.). **Mechanical transmission of an Apple mosaic virus.**—*Hilgardia*, **23**, 15, pp. 613–628, 5 figs., 1955.

At the California Agricultural Experiment Station an apple mosaic virus,

obtained from a single infected tree and transmitted to potted apples by grafting, was mechanically transmitted (by means of carborundum abrasion) to tobacco and a number of other plants and transmitted by dodder (*Cuscuta subinclusa* and *C. campestris*) from tobacco to apple. Mechanical inoculation from apple to apple failed. Infection of bean (*Phaseolus vulgaris*) [*R.A.M.*, 33, p. 203] was improved by quick drying of the inoculated leaves, by addition of potassium hydrogen phosphate and sodium sulphite to the inoculum, by rust (*Uromyces phaseoli*) [*U. appendiculatus*] infection, and by preliminary shading. Inoculation of tobacco produced large etched rings and finally new growth without symptoms, which was immune from further infection and contained more virus than the inoculated leaves, or than any other source of the virus tested.

Cross-protection tests on tobacco differentiated the virus from tobacco ring spot and alfalfa [lucerne] mosaic viruses. Though no direct comparison has been made it is similar to tobacco streak virus in host range, stability, and reaction of tobacco.

Goodman (R. N.) & Shepard (P.). **Indications of Xanthomonas pruni control with antibiotic sprays.**—*Plant Dis. Reptr*, 40, 2, pp. 93–102, 1 fig., 1 diag., 1956.

In experiments at the Missouri State Fruit Experiment Station, Mountain Grove, in 1955 agrimycin (50 and 100 p.p.m.) appreciably reduced leaf spotting and defoliation caused by *Xanthomonas pruni* in four peach varieties [*R.A.M.*, 35, p. 107] when the first of the five or seven sprays was applied four weeks after bloom and the following ones after extended rain periods, or with a minimum interval of seven days between the applications. Since no fruit was set because of severe frost, the effectiveness of the spray schedule in controlling fruit infection could not be ascertained.

Crosse (J. E.). **An epidemic leaf spot and spur wilt of Cherry caused by Pseudomonas mors-prunorum.**—*Rep. E. Malling Res. Sta., 1955*, pp. 121–125, 5 pl., 1956.

The information contained in this paper has already been noticed from other sources [*R.A.M.*, 35, p. 779 and above, p. 874].

Miller (P. R.). **Plant disease situation in the United States.**—*F.A.O. Pl. Prot. Bull.*, 4, 1, pp. 7–10, 4 figs., 1955.

In this report an account is given by A. W. Helton (of the Idaho Agricultural Experiment Station) of symptoms of virus ring spot and related disorders of sweet cherry [cf. *R.A.M.*, 35, pp. 304, 688] in Idaho. The following symptoms have been observed, and it appears that environment is closely related to their expression. Line pattern symptoms include many variations, such as a pale, jagged V-shape at the tip of the leaf, pale chlorotic, concentric circles, a bright yellow, jagged line, or a blotchy cross between the line and circle patterns, either pale or bright. True ring spots of varying type, usually both chlorotic and necrotic, are found, and also a green ring mottle on pale or yellow leaves. Tatter leaf symptoms may accompany virus necrosis, or be caused by insects, frost damage, or sometimes zinc deficiency.

Mosse (Barbara). **Fructifications of an Endogone species causing endotrophic mycorrhiza in fruit plants.**—*Ann. Bot., Lond.*, N.S., 20, 78, pp. 349–362, 4 pl., 4 figs., 1956.

A full account is given of the association between a hitherto undescribed *Endogone* sp. and mycorrhizal strawberry roots at East Malling Research Station [*R.A.M.*, 32, p. 496]. Typical vesicular-arbuscular infections were produced in strawberry, apple, and several other plants by inoculating sterilized soil with the fructifications and with spores excised from them. These experiments constitute

the first record of the establishment of endotrophic mycorrhiza in plants raised aseptically.

Schmidle (A.). **Phytophthora cactorum (Leb. et Cohn) Schroet. als Schaderreger an Früchten der Erdbeere.** [*Phytophthora cactorum* (Leb. & Cohn) Schroet. as a pathogen of Strawberry fruits.]—*Phytopath. Z.*, 26, 4, pp. 449–456, 5 figs., 1 graph, 1956.

There have been few references to the occurrence of *Phytophthora cactorum* on strawberries in Germany [*R.A.M.*, 33, p. 489], and the author consequently reports an outbreak of leather rot in a three- to five-year-old planting covering an area of 2·5 ares [1 are = 119·6 sq. yds.] at Heidelberg in 1955. According to the owner the losses in the early part of the season amounted to 80 per cent. of the crop but subsequent reductions were negligible.

Strawberries at the Horticultural Institute, Heidelberg, were also attacked by *P. cactorum* in the same year, but the resultant damage was insignificant, possibly because of the protection conferred by the wood fibre dressing on the beds.

Posnette (A. F.). **Strawberry mosaic virus disease.**—*Rep. E. Malling Res. Sta., 1955*, p. 120, 1 pl., 1956.

Strawberry mosaic virus disease, a new disease found on Royal Sovereign in Somerset (Cheddar) and Kent, is described. Infected plants are stunted and the dwarfed leaves distorted, the leaflets being constricted and puckered at the base. Variable yellow areas occur irregularly on the leaf, especially near the midrib and at the base of the leaflets. Necrotic spots are absent unless [strawberry] crinkle virus is also present. *Pentatrichopus fragaefolii* failed to transmit the disease, which was, however, transmitted by grafting to Royal Sovereign. The symptoms differed slightly in the two areas concerned, and two strains of the same virus are therefore assumed to occur.

Schöniger (G.). **Erdbeervirosen in Deutschland. II. Isolierung nicht persistenter Viren aus einigen Kultursorten.** [Strawberry viroses in Germany. II. Isolation of non-persistent viruses from some cultivated varieties.]—*Phytopath. Z.*, 26, 2, pp. 113–123, 2 figs., 1956.

Further studies in the present series at the Max Planck Institute for Plant Breeding, Köln-Vogelsang, Germany, were concerned in the first place with the analysis of the German strawberry virus complex classified as group 5 by Schöniger and Bauer [*R.A.M.*, 35, p. 378] from the Pillnitz variety by means of *Pentatrichopus fragaefolii*, with special reference to its non-persistent components. Other analytical experiments were performed with groups 2 and 3 (strongly marked symptoms) [loc. cit.] from Selection 6 and Hochgenuss von Erfurt, respectively. The non-persistent components of all three groups were in reasonably close agreement with the strawberry mottle virus (virus 1) reported from England [32, p. 573], yellows from Canada [31, p. 499], and the United States virus 1 [31, p. 288]. All are consequently referred to the first named [see above, p. 875].

Harris (R. V.) & Posnette (A. F.). **The production and distribution of virus-free fruit trees at East Malling.**—*Rep. E. Malling Res. Sta., 1955*, pp. 115–119, 1956.

In this paper, read at the 14th International Horticultural Congress, July, 1955, the authors outlined the progress made in producing healthy fruit clones [*R.A.M.*, 34, p. 39]. Bulking of sound strawberry stock, for instance, involves propagation over two-year periods to produce some 600,000 plants per annum; this is carried out by Nuclear Stocks Association, Ltd. Virus-free material is obtained either from a supposedly healthy source and checked by re-indexing, or if such is not available, by heat treatment or propagation of young shoots [35, p. 615]. Suitable indicators

for stone fruit viruses are named [cf. 35, p. 776] and reference made to selection of apple material free from rubbery wood virus [34, p. 729]. Quince E seedlings, open-pollinated, are generally good indicators for pear viruses [34, p. 770], but those which have a genetic abnormality similar to white crinkle in cherries are not. As the ring spot virus in *Prunus* is seed transmitted and seed transmission of apple and pear viruses needs further investigation, seedlings for rootstocks must originate from healthy clones. Fruit viruses in England are generally spread by propagation rather than by vectors; where the latter does occur, suitable isolation of healthy parent clones must be ensured.

Moriondo (F.). **Un nuovo parassita dell' Olivo.** [A new parasite of the Olive tree.] —*Olearia, 1955*, 3–4, 5 pp., 5 figs., 1955. [French, English, and German summaries.]

In 1954 at the Institute [of Agricultural and Silvicultural Pathology of the University of Florence] a new disease causing heavy losses to olive seedlings was found to be due to a species of *Oidiopsis*, the mycelium of which develops in the tissues of the leaf. The leaves of the affected plants had large yellowed patches on the upper surface and a whitish efflorescence on the lower. The conidia measured 50 to 90 by 13 to 21 $\mu$.

The author was at first under the impression that *Oidiopsis* had never before been reported as affecting olive trees, but when about to go to press he heard that cases had been observed in Sicily three years previously and were being studied.

Castellani (E.). **Problemi fitopatologici della bananicoltura somala.** [Phytopathological problems of Banana cultivation in Somaliland.]—*Relaz. Monogr. agr. subtrop. trop.*, N.S., 73, 81 pp., 13 pl., 1 diag., 3 graphs, 1955.

In this monograph, based on information obtained during a visit to Somaliland lasting from 26th July until 8th September, 1954, the author deals with the banana plant in relation to its environment, the diseases present in banana plantations in Somaliland, losses in transit, and the biology and control of *Gloeosporium musarum*. In the chapter dealing with diseases in the plantations (pp. 20–32) notes are given on the symptoms, prevalence, and control of a condition apparently identical with 'infectious chlorosis' (*Cucumis* virus 1) [cucumber mosaic virus: cf. *R.A.M.*, 28, p. 130; 34, pp. 138, 518]; leaf spots due to *Helminthosporium torulosum* [C.M.I. map No. 175], *G. musarum* [cf. 34, p. 517], and some minor fungi; fruit infection by *G. musarum*; cigar-end rot (*Stachylidium* [*Verticillium*] *theobromae*) [C.M.I. map No. 146]; black tip due to *H. torulosum*; and fruit rot caused by *Nigrospora oryzae*. The chapter on the control of *G. musarum* discusses 'direct' control by the use of improved sanitary methods in the plantations, spray treatments, and the disinfection of the cut bunches, wrappers, and ships' holds; and 'indirect' control by building up the natural resistance of the plants by suitable methods of manuring, irrigation, etc., reducing mechanical injury, and ensuring that the pre-climacteric stage of development of the fruit (i.e. the period of low respiratory activity, when the fruit is least susceptible to *G. musarum*: R. Deullin: *J. Mar. march. Nav. aér.*, 34, pp. 2831–2838, 1952) coincides with the period between cutting the fruit and its removal to the ripening chambers.

A bibliography of 25 titles is appended.

**Annual Report of the Cameroons Development Corporation, 1955.**—33 pp., 4 pl., 1956.

In the agricultural activities section (pp. 6–10) of this report [cf. *R.A.M.*, 35, p. 277] it is stated that banana leaf spot [*Mycosphaerella musicola*: C.M.I. map No. 7 and following abstracts], initially reported from the Cameroons in 1941, caused considerable damage for the first time during 1955, the occurrence of the perfect state

of the fungus being newly recorded. The recently introduced variety, Lacatan, proved susceptible to the disease in field tests [cf. *R.A.M.*, 35, p. 749].

Champion (J.). **La culture bananière en Colombie (Región de Santa Marta).** [Banana cultivation in Colombia (Santa Marta region).]—*Fruits d'outre mer*. 10, 2, pp. 53–58, 12 figs., 1955.

Referring to banana diseases in this article (pp. 56–57) the author notes that panama disease [*Fusarium oxysporum* f. *cubense*] is still absent from the Santa Marta region of Colombia [*R.A.M.*, 29, p. 36] although present on the Pacific coast of that country. Sigatoka disease [*Mycosphaerella musicola*: see preceding and next abstracts] is prevalent in the conidial state (*Cercospora musae*). Dusting from the air has been attempted to control Sigatoka, but in general Bordeaux mixture is still relied upon, prepared on the large plantations centrally and distributed by permanent pipelines. On one plantation, however, copper oxychloride (with a Shell wetter) is used.

Brun (J.) & Champion (J.). **La culture bananière au Cameroun Britannique.** [Banana cultivation in the British Cameroons.]—*Fruits d'outre mer*, 10, 4, pp. 163–170, 9 figs., 1 map, 1955.

The authors describe conditions on the banana plantations in the British Cameroons and cite three diseases as prevalent: Panama disease (*Fusarium oxysporum* f. *cubense*) [*R.A.M.*, 35, p. 277], Sigatoka (*Cercospora musae*) [*Mycosphaerella musicola*: see preceding abstracts], and fruit rot (*Trachysphaera fructigena*) [35, p. 278], the first named being the most serious.

The zone most affected by Panama disease is Tiko: the higher regions (Moliko) were scarcely touched. All the usual phytosanitary measures thus far applied have been ineffective and the growth of resistant varieties such as Poyo (Robusta or Congo) and Lacatan [cf. 35, p. 275] is recommended.

Sigatoka is not yet a serious threat, probably because the fungus is only present in the conidial state. Spraying with Bordeaux mixture distributed through fixed pipe-lines had been started but results were not yet available.

The disease due to *T. fructigena* results in a general wet rot of the developing fruit, as opposed to the cigar-end disease caused by *Stachylidium* [*Verticillium*] *theobromae* [34, p. 633], which causes a localized dry rot. Incidence was greatest in the higher regions. The following treatments had been tried experimentally: overall spraying with Bordeaux mixture at 8- and 15-day intervals; spraying the bunches alone with perenox from a minimicron atomiser; and deflowering by hand with a special saw-toothed rubber instrument which removes the flowers without damaging the immature fruit.

Rodriquez (D. W.). **Bananas. An outline of the economic history of production and trade with special reference to Jamaica.**—*Commodity Bull. Dep. Agric. Jamaica* 1, 69 pp., 2 pl., 1 fig., 4 graphs, 2 maps, 1955. 3*s*. 6*d*.

Included in this bulletin on all the economic aspects of banana production in Jamaica is a brief chapter (pp. 51–54) on diseases. By far the heaviest losses are caused by Panama disease (*Fusarium oxysporum* [f.] *cubense*) and leaf spot (*Mycosphaerella musicola*) [loc. cit.].

Spencer (J. L.) & Kennard (W. C.). **Outbreaks and new records. Puerto Rico.**—*F.A.O. Pl. Prot. Bull.*, 4, 3, p. 43, 1955.

A blossom blight and brown rot of mangoes in Puerto Rico was caused by *Physalospora perseae* [cf. *R.A.M.*, 3, p. 92]. Premature dropping of the fruit occurs, sometimes involving over 90 per cent. of those under 1 cm. in diameter. Twigs and small branches may also be attacked and cankered.

Gustafson (C. D.). **Avocado diseases.**—*Calif. Citrogr.*, 41, 11, pp. 409–413, 1956.

This popular article on diseases of the avocado pear deals with root rot [*Phytophthora cinnamomi*: *R.A.M.*, 34, p. 782 *et passim*]; sun blotch virus [34, p. 660]; *Verticillium* wilt [*V. albo-atrum*: 35, p. 468]; *Armillaria* root rot [*A. mellea*: 14, p. 707]; *Dothiorella* fruit rot [*Botryosphaeria ribis*: 34, p. 782] and bark cankers caused by the same fungus, as well as by others; corky blemishes due to abrasion of the skin; end spots due to drought, causing the basal end of the fruit to crack, and affecting varieties differently; sunburn, appearing as yellow to black areas on fruit and branches; shedding of flowers and fruit, due to meteorological causes not properly understood; ring neck, also of uncertain origin [16, p. 623]; leaf burn, due to various causes [cf. 35, p. 202]; and nutritional problems arising from deficiencies of zinc [35, p. 293], iron, and nitrogen. Corrective or control measures are indicated.

Gorinova (Mme Y. V.). Значение искореняющего опрыскивания для защиты Винограда от поражения мильдью и Яблони паршой. [The importance of eradicant spraying for the protection of Vine against mildew and Apple against scab infection.]—Докл. Акад. сельскохоз. Наук Ленина. [*Rep. Lenin Acad. agric. Sci.* = *Proc. Lenin Acad. agric. Sci.*], 21, 4, pp.15–20, 1956.

Apple scab [*Venturia inaequalis*: *R.A.M.*, 33, p. 34] and vine mildew [*Uncinula necator* and *Plasmopara viticola*: 35, p. 864] are the most dangerous diseases on these crops in the Krasnodar region of the U.S.S.R., regularly reducing the yield and quality of the fruit. At the Slavonic Base of the Pan-Soviet Scientific Research Institute of Plant Protection applications of either 0·5 per cent. selinon or 2 per cent. preparation 47 at [? up to] 800 l. per ha. to the soil and fallen leaves in and between the rows (for vine between only) in early spring, followed by 1 per cent. Bordeaux mixture on the plants in the spring and summer, prevented mass outbreaks of both diseases and controlled the overwintering stages of the fungi. Thus, in 1951 on apple trees receiving five Bordeaux sprays, scab on the leaves was reduced from 29·2 (soil not treated previously) to 10·2 (selinon) and 9·5 per cent. (preparation 47), the corresponding figures for fruit infection being 86, 19·1, and 42 per cent. Similarly, in 1952, vine mildew was reduced to 16 per cent. on the leaves at the time of mass infection by treating the soil with eradicant and then applying five Bordeaux sprays, as compared with 20·2 per cent. for Bordeaux alone, and to 10·1 per cent. on the fruit at harvest (as against 13 per cent.).

The eradicants are insecticidal as well as fungicidal and may reduce by one or two the number of summer Bordeaux sprays required against the conidial stages of the fungi.

Kirby (A. H. M.). **Plant protective chemistry.**—*Rep. E. Malling Res. Sta., 1955*, pp. 47–49, 1956.

Investigations at East Malling showed a series of 4-alkyl-2 mercapto-glyoxalidines to be non-toxic to spores of *Venturia inaequalis* even at 0·01 per cent., but 3:5-dimethyl-tetrahydro-1:3:5-thiadiazine-2-thione (the active principle of Crag 974 and N. 521) completely inhibited germination of *V. inaequalis* [cf. *R.A.M.*, 34, p. 40] and *Botrytis cinerea* at 0·01 per cent., though it was less effective than captan at 0·001 per cent. A number of products of oxidation of nabam [cf. 34, p. 738] with air or oxygen in general totally inhibited spore germination of *V. inaequalis* at 5 to 10 p.p.m., but only slightly at 1 p.p.m., being rather more toxic than captan. They were less effective against *B. cinerea*.

Copper ions were found to be withdrawn from dilute copper sulphate solutions very rapidly by spores of *B. cinerea*, the amount subsequently decreasing with the external concentration. At low external concentrations over half the copper ions may be removed, but at levels necessary for fungistatic effect the increase from $ED_5$ to $ED_{95}$ is accompanied by very little increase in copper content of the spores.

Somers (E.). **The role of supplements in copper fungicide sprays.**—*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 111–115, [1956].

The author discusses the effect of supplements (such as deflocculating agents, spreaders, and stickers) on the fungitoxic value and coverage of spray deposits, and the level remaining after exposure of copper sprays to weathering. While aiding one of these factors the supplement may adversely affect the others. Stickers may increase the tenacity of a spray deposit but lower its fungicidal efficiency, whereas wetting agents may increase its coverage but lower its initial deposit, rendering it less resistant to rain. Many surface-active agents disperse the fungicide in the tank but have an adverse effect on spray retention, particularly in the case of low-volume sprays, where the use of colloidal fungicides or addition of a dispersing agent drying to give an insoluble residue would be preferable. Increased attention to spray formulation for particular purposes is essential.

Investigation of the tenacity of copper fungicides showed, *inter alia*, that variation of tenacity is more dependent on the chemical nature of sprayed surfaces than on their microstructure; that the deformability of the fungicide particles was independant of size; that the biological effectiveness of the deposits increased with decreasing particle size to 6 $\mu$ and then remained constant; and that wind, apart from rain, could reduce deposits by 50 per cent. after 27 days' exposure. The latex-form synthetic resin emulsions such as PVA and PVC (polyvinyl acetate and chloride) proved least likely to reduce the fungicidal potency of cupric oxide. The maximum spray deposits were obtained with polyethenoxy surface-active agents.

Martin (J. T.). **Spray application problems : XXI. The rapid assessment of deposits of copper fungicides.**—*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 98–102, 1 graph [1956].

Further studies in this series [cf. *R.A.M.*, 35, p. 692 and following abstracts] at Long Ashton Research Station, Bristol, describe methods for the rapid determination of surface copper spray deposits on small areas of leaf tissue and for the quantitative assessment of the efficiencies of distribution of copper by different treatments. Analysis of the copper was achieved by swirling the leaf sample in 10 ml. of N sulphuric acid and 1 spot of wetter, allowing to stand for 10 minutes, and adding 5 ml. each of ammoniacal ammonium citrate solution and of a dihydrazone reagent (*Chem. & Ind.* (*Rev.*), p. 461, 1954), with swirling. Failure of a blue colour to appear, if due to acidity, is corrected by adding a few more drops of the ammonia solution. After allowing the mixture to stand for 45 minutes, with occasional agitation, the optical density of the colour is measured spectrophotometrically, using the Unicam S.P. 600 instrument set at 595 m$\mu$ and a 1 cm. cell, or compared with a standard coloured solution prepared from copper sulphate, in a Duboscqu-type colorimeter.

Analysis of discrete areas of surface determines the variation in intensity of deposition, giving the mean level of deposit ($\mu$) and its standard error ($\sigma$). The efficiency of distribution may be measured by calculating the percentage coefficient of variation, $V$, where

$$V = \frac{100\,\sigma}{\mu}$$

$V = 0$ denotes perfect distribution; the less efficient the distribution, the greater will be the value of $V$.

Martin (J. T.) & Pickard (J. A.). **Spray application problems: XXII. Determination of captan deposits : II.** -*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 103–105 [1956].

In further studies in this series [see preceding and following abstracts] a modification (fully described) of the method used in previous trials [*R.A.M.*, 35, p. 692]

was tested in 1955 at the Luddington Experimental Horticulture Station to compare deposits of captan resulting from spray and dust treatments of strawberries. A dispersable powder containing 50 per cent. captan and used at 0·25 per cent. was applied at 200 gals. per acre and a dust containing 10 per cent. captan at 32 lb. per acre. The deposits on fruits and calyces from four applications of dust did not nearly approach those from the spray (1·9 and 220 p.p.m. as opposed to 3·3 and 880), but the spray deposits on fruits were lower than those obtained the previous year, and further investigation is required.

Bennett (S. H.) & Furmidge (C. G. L.). **Spray application problems : XXIV. The study of plant surfaces and spray deposits by means of transparent impressions.** —*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 121–124, 2 pl. [1956].

In further investigations on problems of spray application [see preceding and following abstracts] two methods for obtaining transparent impressions of plant surfaces in cellulose acetate and gelatin were modified to facilitate the study of spray deposits and organisms thereon. The modified cellulose acetate method (*Lab. Practice*, 3, p. 377, 1954) requires practice, but is ideal for studying deposits of copper fungicides and of lime-sulphur, which are removed completely from the leaf surface and can be developed with a solution producing a highly coloured compound. A piece of cellulose acetate film 0·005 in. thick is attached to a glass plate by moistening the ends with 5 per cent. cellulose acetate in acetone. An area of the upper surface is then smeared with the same solution and immediately covered by the leaf, pressing very firmly for 20 seconds. After hardening of the film (30 to 60 seconds later) the leaf is peeled off. In the case of Bordeaux mixture a solution of sodium diethyldithiocarbamate converted the copper into a dark brown complex, whereas lime-sulphur was developed with a solution of lead acetate, which produced a black deposit.

The gelatin method (*Nature*, 165, p. 273, 1950), suitable for materials soluble in acetone, such as organic insecticides and fungicides, but not for water-soluble spray deposits, consists in heating equal quantities of gelatin and water in a water-bath at 60° C. to produce a homogeneous mass, a small quantity of which is then smeared on a previously warmed slide. The leaf is then pressed lightly but thoroughly into this and peeled off after the film has set (15 to 30 minutes later at room temperature).

These methods are also useful for studying the distribution and development of fungal spores, and by removal in a cellulose acetate impression and staining with a suitable dye it is possible to study on a single impression both the distribution of the fungicide and the spore development.

Butt (D. J.). **Spray application problems : XXVI. The range of fungicidal action of micro-deposits of captan on artificial surfaces and on leaves.**—*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 127–135, 2 graphs [1956].

In a further contribution to this series [*R.A.M.*, 35, p. 692, and preceding and following abstracts] the author used a method similar to that of Morgan [33, p. 199] to investigate the action of captan on spores of *Venturia pirina*. The minimum strength tested was 0·1 per cent. captan, as used in the field (i.e. 0·2 per cent. of a 50 per cent. captan formulation containing a dispersing agent). Smaller deposits than those given by the micropipette [loc. cit.] were obtained by a spinning disk technique, the captan suspension splashing from a revolving plastic disk on which it fell, and striking the leaf through a mask with suitable apertures.

Experiments in which spores and captan were placed on opposite sides of the leaf, or separated from each other on the leaf surface, and assays of halves of the same leaf treated and untreated with captan, indicated that no movement of the fungicide occurs in leaf tissue. It is therefore assumed that fungicidal action is through

the water layer linking the captan deposit to the spores. Although the optimum droplet diameter in spray mists for fruit trees may be 60 to 80 $\mu$, in practice this is often exceeded, but the spinning-disk showed that droplets of 150 $\mu$ diameter inhibit spore germination for 17 hours if the fungicide covers 15 per cent. of the area, which is, however, near the minimum coverage for effective performance.

Kearns (H. G. H.) & Morgan (N. G.). **Spray application problems : XXVIII. A compressed air spray nozzle for laboratory and field equipment for small-volume airflow spraying.**—*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 146–150, 1 pl., 1 diag. [1956].

In further studies in this series [see preceding and following abstracts] a small-volume, compressed airflow nozzle, providing a uniform distribution of small droplets, has been designed and is described and figured, with a full specification [cf. *R.A.M.*, 30, p. 236]. It was found to be useful both for the laboratory and the field and could be used singly or several together for mist sprayers, assembled in the form of a straight manifold. Such a nozzle is easy to manufacture and maintain provided the throughput does not exceed 10 fl. oz. per minute. It consists of a liquid feed tube surrounded by an air annulus, the component parts being readily made of brass, bronze, or monel metal. A change in droplet size is possible by suitable adjustment.

Kearns (H. G. H.) & Morgan (N. G.). **Spray application problems : XXIX. A tractor driven airflow mist-blower for experimental work.**—*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 151–155, 2 pl. [1956].

A brief specification is given of a tractor-driven, airflow mist-blower (a modification of a previous model [*R.A.M.*, 31, p. 194]) which is useful for experimental work on temperate and tropical crops and has been used successfully on bush apples and coco-nuts. The machine is mobile and is designed for wheeled tractor haulage and power take-off drive suitable for applying all types of spray materials in small and large volumes with a droplet size adjustable from 25 to 250 $\mu$ in diameter, depending on the throughput.

Byrde (R. J. W.) & Woodcock (D.). **Fungicidal activity and chemical constitution. III. Pentachlorophenol derivatives.**—*Ann. appl. Biol.*, 44, 1, pp. 138–144, 1956.

In this third contribution to the present series of papers [cf. *R.A.M.*, 33, p. 543] the authors present the results of experiments conducted at Long Ashton Research Station in which nine derivatives of pentachlorophenol were tested both for fungistatic activity against *Botrytis fabae*, *Sclerotinia laxa*, and *Stereum purpureum* and for phytotoxicity towards tomato, apple, and plum.

The most strongly fungitoxic of the compounds was the acetyl ester, but its phytotoxicity, though much lower than that of pentachlorophenol itself, precludes its use as an eradicant fungicide on foliage.

The evidence obtained indicated that the activity of the esters tested may largely arise from their enzymatic hydrolysis, at least in small amounts, to pentachlorophenol, and that the decrease in activity of the higher homologues results from their less readily effected hydrolysis. The fungitoxicity of the acetyl and propionyl esters appears to be strongly affected by pH over the range 5·4 to 7·5, toxicity declining with increasing acidity.

The pentachlorophenyl ethers and the benzoyl ester exerted a relatively low fungistatic activity, presumably because less susceptible to enzymatic attack. They were also much less phytotoxic than the parent phenol.

Van Raalte (M. H.), Sijpesteijn (A. K.), Van der Kerk (G. J. M.), Oort (A. J. P.), & Pluygers (C. W.). **Investigations on plant chemotherapy.**—*Meded. LandbHogesch. Gent*, 20, 3, pp. 543–555, 4 figs., 1955.

Working at the Phytopathological Laboratory, Wageningen, Holland, on the

dithiocarbamate fungicides [*R.A.M.*, 35, p. 310] the authors tested a number of compounds of the general formula $(CH_3)_2$ N–C(=S)–SR, in which R was a hydroxyethyl or other group, in an endeavour to find a substance that would be transportable in the plant. Solutions of the compounds were watered into the soil or a petiole was immersed in them, the plant concerned being subsequently inoculated. One of these compounds, S-(carboxymethyl)-N, N-dimethyldithiocarbamate (= G 33), a weak growth substance, reduced infection of cucumber by *Cladosporium cucumerinum* and tomato by *C. fulvum*. It also checked infection of peas by *Mycosphaerella pinodes* if sprayed on to leaves before inoculation, but not if applied through the roots. A similar compound, S (2-carboxypropyl-2)-N, N-dimethyldithiocarbamate, did not have the epinastic effect produced by G 33 on tomato, but protected cucumber from infection equally well, indicating that the protective action of G 33 is not due to its effect as a growth substance. Both compounds were phytotoxic at concentrations exceeding 500 mg. per l.

Natti (J. J.) & Schroeder (W. T.). **Protectant seed treatments for vegetable processing crops.**—*Bull. Cornell agric. Exp. Sta.* 771, 46 pp., 1 fig., 1 graph, 1955.

This publication deals with 11 years' experimental work at the New York State Agricultural Experiment Station, comparing a number of seed treatments suitable for bean [*Phaseolus* spp.], carrot, maize, cucurbits, crucifers, pea, [chilli] pepper, spinach, and tomato. The results are presented for each crop together with a discussion of the better treatments. On peas, thiram, captan, and dichlone were superior to chloranil under greenhouse conditions greatly favouring seed decay, but chloranil was as good or sometimes better in the field, and did not tend to retard flow through the drill like the others [cf. *R.A.M.*, 35, p. 651]. A list of fungicides and their active ingredients is included.

Hurtig (H.), Mann (S. L. W.), Hopewell (W. W.), & Gravells (R.). **A new technique for sampling and assessing aerial spray deposits.**—*Canad. J. agric. Sci.*, 36, 2, pp. 81–94, 1 pl., 2 graphs, 1956.

A description is given of a new, rapid, photographic method of quantitative assessment of aerial spray deposits on Printflex cards (*Bi-m. Progr. Rep., Div. For. Biol., Agric. Can.*, 8, 2, 1952), which serve as a satisfactory surface for collecting samples of such sprays. By this method accurate assessment, not requiring any further optical aids, can be made of the density of deposit, number of droplets per unit area, and mass median diameters of the spray sample. Use of a high contrast, light weight, photographic paper eliminates the necessity for film, and a permanent record is provided, enlarged 3·5 ×, and with a calibration grid recorded on the print.

Frear (D. E. H.). **Pesticide handbook.**—208 pp., Pennsylvania State College, College Science Publishers, 1956. $1.25.

The eighth annual revised edition of this handbook [cf. *R.A.M.*, 34, p. 467] contains the names of 6,111 commercial pesticides together with information on their uses, ingredients, and manufacturers. In addition to the features of previous editions a list of pesticide tolerances [35, pp. 472, 836] is included.

Rushdi (M. H. K.). **Effect of some soil factors on efficiency of fungicides in controlling Rhizoctonia solani Kuhn.**—*Diss. Abstr.*, 15, 11, p. 1991, 1955.

Much of this information concerning studies on *Rhizoctonia* [*Corticium*] *solani* at the University of Maryland has already been noticed from another source [*R.A.M.*, 35, p. 632]. Using a liquid medium, 4 p.p.m. phenyl mercury triethanol

ammonium lactate, 20 p.p.m. thiram, hydroxymercurichlorophenol, sodium dimethyldithiocarbamate, sodium 2-mercaptobenzothiazole, and ziram completely inhibited the growth of *C. solani*; 20 p.p.m. ferbam and actidione caused 75 per cent. inhibition. At 200 p.p.m. cuprous oxide and tribasic copper sulphate caused little reduction in growth.

Kearns (H. G. H.) & Morgan (N. G.). **Spray application problems : XXX. Mobile observation platforms for the examination of tree crops.**—*Rep. agric. hort. Res. Sta. Bristol, 1955*, pp. 156–158, 2 pl. [1956].

Two observation equipments are described, useful for assessing disease infections and spray deposits or for photographing *in situ*, and which allow ready access to most parts of trees. The first, a tractor-mounted observation platform, is intended for trees up to 18 ft. high, while an extending, self-supporting steel ladder, moved by a tractor or truck before manhandling into field position, is designed for trees up to 72 ft. high and has been used successfully on coco-nut plantations in Zanzibar and the Solomon Islands.

**Crop protection products approval scheme. Approved list 1955.**—16 pp., London, Ministry of Agriculture and Fisheries, 1955.

The twelfth edition of the list of insecticides and fungicides marketed in Great Britain under proprietary brand names and approved by the Ministry of Agriculture, Food, and Fisheries and the Department of Agriculture for Scotland [cf. *R.A.M.*, 26, p. 70] replaces that published in October, 1954. It covers approved fungicides (pp. 9–11), seed dressings (pp. 11–12), and the names and addresses of their manufacturers (pp. 15–16).

Baldacci (E.). **La patologia vegetale oggi.** [Plant pathology today.]—Reprinted from *Boll. Agric., Milano*, 47–48, 13 pp., 1955.

In this lecture, given before the Agricultural Society of Lombardy on 26th November, 1955, the author discoursed upon the general aims of plant pathology and the results obtained in the past. The importance of the correct interpretation of symptoms was noted, and a distinction drawn between groups of pathogens which cause localized toxicity in the plant, those which form a nutritional relationship with the host, and those which induce abnormal growth. The need to study the host in relation to its susceptibility or resistance was stressed, and the close relationship between plant physiology and plant pathology emphasized. The paper concludes with a section on epidemiology.

Preston (D. A.) & Dosdall (Louise). **Minnesota plant diseases.**—*Spec. Publ. agric. Res. Serv., U.S. Dep. Agric.* 8, 184 pp., 1955.

In this useful compilation all the available information on the occurrence and distribution of 3,176 plant diseases on 1,156 hosts in Minnesota, based on published reports, collections in the herbaria of the University of Minnesota, and the writers' own collections, is presented in the form of a host index. Indexes are also provided to the pathogens or causal agents, with lists of hosts, and to the common names of the host plants.

Hrushovetz (S. B.). **Cytological studies of Helminthosporium sativum.**—*Canad. J. Bot.*, 34, 3, pp. 321–327, 2 pl., 1956.

At the Department of Botany, University of Toronto, cytological studies of *Helminthosporium sativum* [*Cochliobolus sativus*: *R.A.M.*, 35, p. 288] showed that a mechanism exists for the perpetuation of heterokaryons. Hyphal tips and mycelial cells are generally initially multinucleate and hyphal fusions occur in all parts of the colony. Young conidia invariably contain several nuclei prior to delimitation

from the conidiophore. Germination of the multicellular, multinucleate conidia is polar or bipolar, but only the nuclei in the terminal cells of the conidium enter the germ tubes; the rest degenerate.

HOYMAN (W. G.). **A large inoculation chamber with automatic temperature and humidity controls.** *Amer. Potato J.*, 33, 7, pp. 214–217, 4 figs., 1956.

This is an expanded account of an apparatus that has already been described in this *Review* [*R.A.M.*, 35, p. 318].

SACKS (L. E.). **A pH gradient agar plate.**—*Nature, Lond.*, 178, 4527, pp. 269–270, 2 figs., 1 graph, 1956.

At the Western Utilization Research Branch of the United States Department of Agriculture, Albany, California, a modification of the Szybalski technique (*Science*, 116, p. 46, 1952) was devised in which a layer of agar containing potassium monohydrogen phosphate was poured into a slanted Petri dish, allowed to set, and an equal quantity of agar with potassium dihydrogen phosphate added with the dish level. A pH gradient of 5·6 to 7·8 across the plate was demonstrated by placing filter paper strips soaked in indicator on the surface for a few minutes, the indicator being transferred to the agar. Using this technique it was shown that streptomycin is more effective against a number of bacteria under alkaline conditions.

GOLDIE-SMITH (KATHLEEN). **Maintenance of stock cultures of aquatic fungi.**—*J. Elisha Mitchell sci. Soc.*, 72, 1, pp. 158–166, 1956.

Studies at the Department of Botany, University of North Carolina, Chapel Hill, showed the following methods were the most successful for storing stock cultures of aquatic fungi in the laboratory: sporophytic hemp seed or grass cultures of Blastocladiaceae (particularly *Allomyces*) and certain of their internal parasites, also some *Pythium* spp., dried slowly on filter paper, can be kept viable for years; storage under mineral oil for agar cultures [*R.A.M.*, 33, p. 245] or cool storage (10° C.) of hemp seed cultures in water with oak leaves for Saprolegniaceae; cool storage of agar cultures for Pythiaceae; and drying in soil for Actinoplanaceae. Individual members of any one group may differ somewhat in their response.

GORDON (W. L.). **A simple and inexpensive method of shipping cultures of fungi by air mail.**—*Canad. J. Bot.*, 34, 3, pp. 417–418, 1956.

In a simple method for transporting viable fungus cultures, devised at the Plant Pathology Laboratory, Winnipeg, a small piece of agar 1 cm. square and 0·5 cm. thick is cut from a culture, preferably one to two weeks old, and inserted in a small, sterile, cellophane envelope which is then folded and sealed with cellulose tape. Ten such may be enclosed in an ordinary air-mail envelope. To recover the fungus in culture the contents of the cellophane envelope are shaken in about 10 ml. sterile, acidified water, which is poured over water agar plates. After incubating for 16 to 24 hours at room temperature conidia or hyphal tips are picked out and transferred to potato sucrose agar.

ZIMMERMAN (P. W.). **Chemicals involved in air pollution and their effects upon vegetation.**—*Prof. Pap. Boyce Thompson Inst.*, 2, 14, pp. 124–145, 7 figs., 1955. Reprinted from *Proc. Governors' Conf. & Exhibit. on Atmospheric Pollution, New Jersey State Dep. Health, Trenton, N.J., February 19–20, 1952*, pp. 23–31, 1955.

This is a brief review of observations and the results of work done at the Boyce Thompson Institute for Plant Research, New York, on the effects of sulphur dioxide gas [*R.A.M.*, 35, p. 533], hydrofluoric acid gas [loc. cit.], chlorine, hydrogen sulphide, ammonia, mercury vapour, ethylene, carbon monoxide, and the vapours

of 2,4-D and similar chemicals on plants. The typical symptoms induced by these common air pollutants are described and illustrated, and a bibliography of 33 titles, some of which have been noticed in this *Review*, is appended.

Basu (S. N.) & Pal (P. N.). **An unfavourable effect of shaking on fungal cellulases.**—*Nature, Lond.*, 178, 4528, pp. 312–313, 1956.

At the Indian Jute Mills Association Research Institute, Calcutta, six cellulase-producing fungi, including *Chaetomium indicum* and *Myrothecium verrucaria*, were grown in liquid culture with filter paper as the carbon source. Flasks which were shaken continuously yielded a lower titre of cellulases in the culture filtrates than those which remained stationary.

Da Costa (E. W. B.), Watson (A. J.), & Hindson (W. R.). **Preservatives for rot-proofing paper.**—*Aust. J. appl. Sci.*, 7, 1, pp. 113–118, 1 pl., 1956.

The experiments described in this joint contribution from the Division of Forest Products, Commonwealth Scientific and Industrial Research Organization, Melbourne, and the Defence Standards Laboratories, Maribyrnong, Victoria, were performed to determine the efficiency of 18 fungicides in the protection of pine kraft paper (a possible substitute for jute sandbags [cf. *R.A.M.*, 35, p. 838] in the construction of revetments) from fungal rots. Matched specimens were dipped in solutions or suspensions at various concentrations and assayed for resistance to decay by 14 days' burial in moist compost at 30° C. and 95 to 100 per cent. relative humidity, as well as by a less exacting test in which they were laid on the surface of a mineral salts-agar medium, sprayed with a mixed spore suspension of *Aspergillus niger*, *A. repens*, *A. flavus*, *Penicillium luteum*, *P. notatum*, *Memnoniella echinata*, and *Rhizopus stolonifer* [*R. nigricans*], and incubated for 14 days at 30°. Complete protection from rotting, without adverse effect on the bursting strength of the paper, was conferred by dipping for 10 seconds in a 0·8 per cent. aqueous solution of phenyl mercuric acetate, 1·2 per cent. sodium pentachlorophenate followed by another dip in 5 per cent. copper sulphate to form copper pentachlorophenate in the paper, or 9 per cent. mercuric naphthenate in mineral turpentine.

It is concluded from these results that the service life of paper, cardboard, and similar products used in contact with moist soil, in prolonged exposure to weather, or in other situations of high decay hazard, may be greatly increased by preservative treatments. Some of those found to be effective in these trials could probably be incorporated in the paper during manufacture.

Ark (P. A.) & Alcorn (S. M.). **Antibiotics as bactericides and fungicides against diseases of plants.**—*Plant Dis. Reptr*, 40, 2, pp. 85–92, 5 figs., 1956.

Most of the information reviewed here, with frequent reference to the literature (19 titles), on the use of antibiotics for the control of fungus and bacterial diseases of plants [cf. *R.A.M.*, 35, pp. 615, 782] has already been noticed from time to time in this *Review*.

Gerstner (W.). **Antibiotische Substanzen von Samenpflanzen.** [Antibiotic substances from seed plants.]—*NachrBl. dtsch. PflSchDienst, Berl.*, N.F., 10, 1, pp. 1–7, 1956.

Many of the 74 contributions to the literature of the production of antibiotics in higher plants, consulted by the author in the preparation of the present survey, have already been noticed [cf. *R.A.M.*, 30, p. 622; 31, p. 134, *et passim*].

Slankis (V.). **Causality of morphogenesis of mycorrhizal Pine roots.**—Abs. in *Proc. Canad. phytopath. Soc.*, 23, pp. 20–21, 1955.

Experimental evidence obtained in the Forest Pathology Laboratory, Maple, Ontario, and morphological studies on pine roots in the field, led the author to

conclude that when the auxins produced by mycorrhizal fungi [*R.A.M.*, 29, p. 44] reach a certain concentration, further elongation of the invaded root is inhibited, root hair formation is prevented, and hypertrophied cortex cells form swellings. If the auxin concentration decreases the root tips renew their longitudinal growth; a succession of these changes results in a series of constrictions and swellings along the root. The growth of long roots may also be inhibited by auxins produced in mycorrhizal short roots, causing spontaneous development of new short roots, usually from the axils of the old ones.

Morphological changes in mycorrhizal roots of other tree species may also be explained by excess of auxin production.

Katsura (K.) & Tokura (R.). **Effect of malachite green upon the sporangial germination, mycelial growth, and sporangial or oospore formation of the fungus Phytophthora capsici Leonian.**—*Sci. Rep. Fac. Agric. Saikyo Univ.* 7, pp. 103–112, 4 graphs, 1955. [Japanese, with English summary.]

At the Faculty of Agriculture, Saikyo University, Japan, indirect germination of sporangia of *Phytophthora capsici* obtained from inoculated eggplant fruits and suspended in a potato decoction containing malachite green [cf. *R.A.M.*, 14, p. 398] was reduced at the lowest concentration of the dye tested, $0{\cdot}1 \times 10^{-4}$ per cent., whereas direct germination was stimulated. No germination occurred above $2{\cdot}5 \times 10^{-4}$ per cent. In distilled water germination was retarded at all levels of malachite green, particularly above $0{\cdot}25 \times 10^{-4}$ per cent. for direct germination and above $0{\cdot}1 \times 10^{-4}$ for indirect. Mycelial growth at 28° C. on potato decoction agar was stimulated by concentrations below $0{\cdot}125 \times 10^{-4}$ per cent. and inhibited between 0·5 and $0{\cdot}25 \times 10^{-4}$ per cent. Oospore formation on oatmeal agar was retarded at $0{\cdot}25 \times 10^{-4}$ per cent. or above, while sporangial formation was not affected.

Shaw (M.) & Samborski (D. J.). **The physiology of host-parasite relations. I. The accumulation of radio-active substances at infections of facultative and obligate parasites including Tobacco mosaic virus.**—*Canad. J. Bot.*, 34, 3, pp. 389–405, 8 pl., 1956.

In studies at the Plant Physiology Laboratory, Department of Biology, University of Saskatchewan, 21 carbon compounds labelled with radio-active $C^{14}$, including carbon dioxide, sugars, amino and organic acids, phenols, and indoleacetic acid, as well as phosphorus $P^{32}$ and calcium $Ca^{45}$, accumulated at colonies of *Puccinia graminis* and *Erysiphe graminis* on excised, infected wheat and barley leaves, respectively [*R.A.M.*, 34, p. 473]. Glucose accumulation increased progressively with the development of the parasite. *E. graminis* was inhibited by sulphur dust, and *E. graminis* and *P. graminis* by sodium azide, 2,4-dinitrophenol, and, reversibly, by anaerobiosis, and was therefore dependent on aerobic respiration. The radio-active tracers did not accumulate in senescent rust or mildew lesions or within infections produced by bacterial and fungal pathogens which kill their hosts. Calcium and phosphorus, but not glucose, accumulated in young local lesions of tobacco mosaic virus on *Nicotiana*. No radio-activity entered dead areas on wounded leaves, and tracers accumulated in fresh wounds only when there was a high rate of water loss, and the accumulation was attributable to this.

These results are in accordance with the hypothesis that a diffusible substance is produced at the site of infection, either by the fungus or the host cells, or both, and stimulates the metabolism of the host in the neighbourhood of the lesion.

Peterson (E. A.) & Katznelson (H.). **The effect of trace elements on growth of Helminthosporium sativum and several related species.**—*Canad. J. Microbiol.*, 2, 4, pp. 441–446, 3 graphs, 1956.

In a further contribution to the study of the nutrition of *Helminthosporium*

*sativum* [*Cochliobolus sativus*: *R.A.M.*, 34, p. 804] zinc, manganese, and iron were shown to be essential for growth, *H. biforme*, *H. halodes*, and *H. setariae* also being stimulated by this combination. Copper, cobalt, molybdenum, boron, and calcium were apparently not necessary, but though all precautions were taken to ensure purity of the media, trace element contamination was still possible from two sources, namely, the spore inoculum and the minerals used for the trace element solutions.

Buston (H. W.) & Kaan (A. H.). **The influence of certain micro-organisms on the formation of perithecia by Chaetomium globosum.**—*J. gen. Microbiol.*, 14, 3, pp. 655–660, 1956.

Further studies at the Department of Botany, Imperial College, London [*R.A.M.*, 33, p. 27] showed that fruiting of *Chaetomium globosum* was stimulated by organic phosphates, particularly phosphoglyceric acid, produced by *Aspergillus fumigatus* growing in its presence. *A. fumigatus* excretes these substances in the earliest stages of its growth, and the fruiting response which they produce can follow even if the colony of *A. fumigatus* is removed after two or three days and the space filled with fresh agar.

Buston (H. W.) & Rickard (Beryl). **The effect of a physical barrier on sporulation of Chaetomium globosum.**—*J. gen. Microbiol.*, 15, 1, pp. 194–197, 1 diag., 1956.

In further investigations at Imperial College [see preceding abstract] increased production of perithecia by *Chaetomium globosum*, growing alone, was observed in the areas of cultures in which there was an increased concentration of organic phosphates due to the presence of a physical barrier, such as the edge of the Petri dish, which hindered diffusion.

Baldacci (E.) & Amici (A.). **Ricerche sulla tossicità del M.C.P.A. (acido 2-meta-4 clorofenossiacetico) e del 2, 4-D (acido 2,4-diclorofenossiacetico) per gli Attinomiceti.** [Researches on the toxicity of M.C.P.A. (2-methyl-4-chlorophenoxyacetic acid) and 2,4-D (2,4 dichlorophenoxyacetic acid) towards actinomycetes.] —*Nuovi Ann. Igiene Microbiol.*, 5, 4, pp. 281–284, 1954. [Received 1956.]

In studies conducted at the Institute of Plant Pathology, University of Milan, Italy, 41 strains of *Actinomyces* and six of *Proactinomyces* [cf. *R.A.M.*, 34, p. 615] were grown on a synthetic medium containing as a carbon source either 2,4-D at a dosage of 0·04 per cent. acid equivalent (corresponding to a molar concentration of 0·0018) or MCPA in the form of the sodium salt at a concentration of 0·1 per cent. (molar concentration 0·0004). After 25 days at 32° C. it was observed that eight strains had failed to grow in the presence of 2,4-D [cf. 28, p. 278; 32, p. 325] and one in that of MCPA.

The experiment was then repeated with the same medium and with MCPA in the form of the sodium salt at a dosage of 0·5 per cent. (0·02 M). A parallel series of cultures was prepared with MCPA at 0·5 per cent. and glucose at 1 per cent. After 25 days, it was found that the 0·02 M dosage had permitted the growth of 13 strains of *Actinomyces* and four of *Protoactinomyces* out of 40; with the addition of 1 per cent. glucose the same amount of MCPA permitted the growth of only two strains of *Actinomyces* and four of *Protoactinomyces*.

Naito (N.) & Tani (T.). **Effect of sodium 2,4-dichlorophenoxyacetate on the proximate composition and the nutritional absorption in Gloeosporium olivarum.** – *Ann. phytopath. Soc. Japan*, 20, 2–3, pp. 89–92, 1955. [Japanese, with English summary. Received 1956.]

In comparative chemical analyses of the mycelium of *Gloeosporium olivarum* grown in culture with or without sodium 2,4-D [*R.A.M.*, 35, p. 703] total nitrogen

was similar in the two series, but lipids and water-soluble substances were lower and hot water and hydrochloric acid extracts higher with 2,4-D. Abnormal nitrogen metabolism in the presence of 2,4-D was indicated by the high ratio of glucose and nitrogen absorbed to the mycelial weight, although mycelial development was much less than in the control cultures.

Henderson (Moira E. K.). **A study of the metabolism of phenolic compounds by soil fungi using spore suspensions.**—*J. gen. Microbiol.*, 14, 3, pp. 684–691, 2 graphs, 1956.

In further investigations at the Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen, of the metabolism of certain phenolic compounds related to lignin [*R.A.M.*, 34, p. 815], the use of spore suspensions in place of mycelium, the spores being pre-incubated for 16 to 17 hours, usually in the presence of yeast extract, secured greater uniformity among the replicates and ensured a study of the physiology of a whole organism, the low rate of endogenous respiration of the spores also being an advantage. The fungi used were species of *Haplographium*, *Hormodendrum*, *Penicillium*, and *Spicaria*. Their power to metabolize *p*-hydroxybenzaldehyde, ferulic acid, syringaldehyde, and vanillin [loc. cit.] was confirmed, the first-named being oxidised more rapidly than the others.

The intermediate products of this metabolism, *p*-hydroxybenzoic, syringic, and vanillic acid, were attacked by adaptive enzymes, the formation of which was greatly decreased by the antibiotic citrinin.

Bazán De Segura (Consuelo). **Phyto-pathological investigations on Potato in Peru.**—*Agric. Res. News Notes*, 2, 1, 2 pp., 1955.

The following potato diseases are found both on the coast and in the Sierra in Peru: late blight (*P[hytophthora] infestans*) [*R.A.M.*, 35, p. 537], wilt [*Fusarium oxysporum* and *F. solani* var. *eumartii*: 25, p. 42], powdery mildew [*Erysiphe ? cichoracearum*], stem rot [? *Corticium solani*: 30, p. 188], black dot [*Colletotrichum atramentarium*: 31, p. 208], *Sclerotinia* rot [*S. sclerotiorum*: 32, p. 147], grey mould [*Botrytis cinerea*: loc. cit.], *Sclerotium* wilt [*S. rolfsii*], and silver scurf [*Spondylocladium atrovirens*: 35, p. 540]. Powdery scab [*Spongospora subterranea*: 25, p. 42], rust [*Puccinia pittieriana*: 11, p. 226], Peruvian rust [*Aecidium cantensis*; loc. cit.], wart [*Synchytrium endobioticum*: 30, p. 188], and the Andean disease (*Thecaphora solani*) [35, p. 391] are found only in the Sierra, though the last-named may possibly attack very susceptible species at lower altitudes [loc. cit.].

Late blight and viruses [35, p. 627] are the most serious diseases. The former is easily controlled by zineb on the coast, where with the light winter rain the tubers do not become infected, but control is more difficult with the higher rainfall of the Sierra, copper compounds being the most effective there. The races of *P. infestans* in Peru are 0 (A); 2,4 (C); 3 (J); and 3,4 (I). Resistant potato varieties are being bred, 53 hybrids of *Solanum tuberosum* ssp. *andigenum* [*S. andigenum*] × *S. antipoviczii* having proved immune [cf. 34, p. 809].

The only virus identified by indexing is potato virus X [25, p. 42]. Purple top [? aster yellows virus], calico [? a strain of lucerne mosaic virus], crinkle [potato viruses X plus A], leaf roll virus, and spindle tuber virus have been provisionally recognized by symptoms, as also has potato virus Y, possibly a recent introduction as it was not found in potatoes collected in Peru in 1937 [18, p. 410].

Bazán De Seguro (Consuelo). **Podredumbre carbonosa de la Papa en el Perú.** [Charcoal rot of Potato in Peru.]—*Bol. Estac. exp. agríc. La Molina* 63, 8 pp., 6 figs., 1956. [English summary. Mimeoprinted.]

Charcoal rot caused by *Macrophomina phaseoli* [cf. *R.A.M.*, 24, p. 96; 34, p. 541] has been observed on potato tubers for the first time in Peru, at the La Molina

Station. This fungus had previously been isolated in Peru from diseased beans [*Phaseolus vulgaris*] and citrus only [32, p. 592].

Wenzl (H.). **Beitrag zur Frage der Virus-Übertragung an gekeimten Kartoffeln durch die Kellerlaus (Rhopalosiphoninus latysiphon Davids.)** [Contribution to the question of virus transmission on sprouted Potatoes by the cellar aphid (*Rhopalosiphoninus latysiphon* Davids.)]—*PflSchBer.*, 17, 5–6, pp. 65–74, 1956.

At the State Institution for Plant Protection, Vienna, from 1953 to 1955, the author studied the incidence of virus disease in plants grown from 9,200 halved potato tubers of a number of varieties, one-half of each tuber being allowed to sprout and subjected to infestation by aphids (*Rhopalosiphoninus latysiphon*) infected with leaf roll and crinkle mosaic [potato virus X+Y] while the control half was kept free from aphids. Positive results were not obtained with all the tests; in one, however, with 1,600 Sieglinde tubers, 5 per cent. transmission of leaf roll was achieved [*R.A.M.*, 32, p. 500]. The author emphasizes that even limited transmission may be important where there is heavy infestation of sprouting tubers in storage.

Gigante (R.). **Osservazioni sulla filosità dei tuberi di Patata.** [Observations on spindle sprout of Potato.]—*Boll. Staz. Pat. veg. Roma*, Ser. 3, 13 (*1955*), pp. 119–131, 7 figs., 1956. [English summary.]

Several years' observations have shown that in Italy spindle sprout of potato tubers may be produced by certain virus diseases, fungal diseases, and environmental factors. Potato crops infected by *Colletotrichum atramentarium* give such tubers [cf. *R.A.M.*, 35, p. 540]; leaf roll virus [34, p. 475] and rugose mosaic virus may also be contributory. High temperatures and drought [cf. 35, p. 482] are the most important environmental factors conducing to spindle sprout. The evidence obtained indicates that spindle sprouts are not symptoms of a definite disease but signs of a weak or unhealthy condition arising from a number of causes.

De Montgremier (H[élène] A.). **Recherches sur la rapidité de migration du virus de l'enroulement en direction des tubercules de Pomme de terre.** [Studies on the rate of migration of the leaf roll virus towards Potato tubers.]—*C. R. Acad. Agric. Fr.*, 40, 17, pp. 663–666, 1954.

Studies were made from 1952 to 1954 in northern Finisterre, France, on the rate of migration of the potato leaf roll virus from the leaves to the tubers of Ostbote and Weisses Rössl potato plants [cf. *R.A.M.*, 32, p. 445] by inoculating them on one shoot only with infective, apterous *Myzus persicae*. The inoculated leaves were enclosed in cellophane to prevent the aphids escaping. The tubers on each plant were harvested separately and infection assessed the following year. The first few tubers were affected after ten days, the virus then spreading, sometimes, to all those on a plant. The percentage affected increased as the number of days between inoculation and burning of the haulms increased, the figures being less than ten per cent. transmission with a ten-day interval, about 20 per cent. at 12 to 15 days, and about 40 per cent. at 20 to 25.

Goerlitz (H.). **Über den Einfluß verschiedener Anbaumethoden auf Ertrag und Pflanzgutwert der Kartoffel.** [On the influence of different methods of cultivation on Potato yield and 'seed' quality.] *Züchter*, 25, 11–12, pp. 351–363, 7 figs., 1 diag., 1956.

This is an amplified version of a contribution from the Agricultural Institute of the University of Rostock, Mecklenburg, Germany, describing experiments from 1950 to 1952 to determine the relative merits of the German, Dutch, and Russian methods of seed potato production in connexion with their influence on virus

diseases, particularly leaf roll. The essential results have already been summarized from another source [*R.A.M.*, 34, p. 668].

McAnelly (C. W.), Payne (M. G.), & Fults (Jess L.). **Detection of Potato leaf roll by paper chromatography and electrophoresis.**—*Amer. Potato J.*, 33, 4, pp. 134–140, 3 figs., 2 graphs, 1956.

In studies of the protein constitution of the expressed sap from Russet Burbank tubers with and without leaf roll an increase in total proteins in the former was revealed by paper electrophoresis and by both one- and two-dimensional paper chromatography [cf. *R.A.M.*, 32, p. 232]. The results of the first two methods were expressed in the form of optical density curves. The one-dimensional chromatographic procedure was the most promising and the authors consider that it should be possible to develop such a chemical test for the quantitative and qualitative estimation of leaf roll. Further investigation is required, however, of the behaviour of other potato viruses, of potato varieties in relation to specific viruses, and of the period involved between virus infection and change in protein content.

MacArthur (A. W.). **Potato virus S.**—*Rep. Scot. Pl. Breed. Sta., 1956*, pp. 27–36, 1 pl., 1956.

Some potato varieties show slight abnormalities when infected with potato virus S [*R.A.M.*, 35, pp. 116, 536, *et passim*]; in many, infected plants are pale and may be chlorotic. Affected plants have not, however, shown any mosaic in Scotland, and attempts there to find hosts and specific indicators in plants other than potato have been unsuccessful. Serological methods were found to be the only certain means of detecting the presence of the virus. The methods of serum production adopted at the Scottish Plant Breeding Station were simpler than those used in Holland [35, p. 480], but the antisera proved adequate for the routine detection of the virus. For more critical determinations, the tube precipitation test was employed, in preparation for which sprouts about 1 in. long, hardened off in daylight, were ground in a mortar, one or two drops of a 0·2 per cent. solution of potassium cyanide being added. Sap was expressed through muslin, diluted to 1/8 to 1/16 with physiological saline, and centrifuged for ten minutes at 3,000 g.

The virus was ascertained to be widespread, and in some older commercial varieties no healthy plant was detected. No natural infections were found, however, in Arran Peak, Craigs Defiance, Craigs Royal, Dunbar Rover, or Dunbar Standard. Tests on several American varieties gave positive results. Two carnation varieties, Allwood's Market Pink and Spectrum Supreme, reacted positively with S antiserum. Examination of commercial and wild potato failed to demonstrate the presence of immunity from or hypersensitivity to the Arran Victory source of the virus.

It has been reported that losses in yield caused by infection may amount to 20 per cent. [cf. 34, p. 245], and preliminary yield trials at the Station in 1955 with Craigs Alliance and Kerr's Pink tended to confirm these results. Trials in France with a potato seedling, however, showed no significant differences between the yields of healthy and infected plants.

The transmission of virus S in the field by foliage contact and cultivation operations may prove to be as frequent as that of virus X. An experiment under glass with virus-tested Arran Peak plants resulted in successful transmission by deliberate handling of the leaves. Hygienic methods effective against the spread of virus X should be equally effective against virus S.

From experimental evidence it is tentatively concluded that potato virus S is serologically related to paracrinkle virus [see above, p. 868].

De Lint (M. M.) & Crucq (J.). **Het loofklappen en doodspuiten in 1955.** [Beating down and lethal spraying in 1955.]—*Landbouwvoorlichting*, 13, 7, pp. 464–475, 5 figs., 1956.

Further exploratory trials were made in seven seed potato-producing districts of Holland during 1955 to determine whether mechanical and chemical haulm-killing are more advantageous than pulling [*R.A.M.*, 35, p. 38], using the Alpha, Bintje, Eigenheimer, and Voran varieties. The differences between the various types of machines tested did not warrant a preference for any particular system, the influence of which is less important than alignment, uniformity of ridges, and a precise adjustment of the beater. Covering the haulm stumps with leaves and soil impaired the effect of chemical killing, which presented many difficulties in this series of experiments owing to the dry summer, three applications being insufficient in some cases, especially for the late varieties, though an improvement resulted from operating in the early morning or in the evening, i.e., under high relative humidity. Arsenite (20 l. per ha.) was the most effective compound tested, but its phytotoxicity limits its use on sandy and clay soils altogether or to one treatment.

Lack of significant discrepancies in [unspecified] virus infections of the tubers with the different methods was probably due to the low aphid infestation in 1955. Owing to the late development of blight (*Phytophthora* [*infestans*]) tuber infection was absent, but beating down and haulm-killing increased the prevalence of *Rhizoctonia* [*Corticium solani*], though less so than in 1954.

In the final resort, the date of the treatments appears to be the principal factor affecting yields. Thus, in six tests carried out between 4th and 24th August the average increase obtained by the mechanical and chemical methods as compared with pulling was 17·4 kg. per are [119·6 sq. yds.]. On the other hand, a delay of four or five days in pulling in North Friesland is stated to have resulted in an increase of 25 kg. per are over beating down and haulm-killing.

Callbeck (L. C.). **Screening of Potato fungicides.**—*Plant Dis. Reptr*, 40, 2, pp. 126–128, 1956.

Of the six fungicides screened for the control of potato blight (*Phytophthora infestans*) [*R.A.M.*, 35, p. 158] in field plots at the Science Service Laboratory, Charlottetown, Prince Edward Island, in 1955, dithane M-22 (maneb, 1·5 lb. per 80 imperial gals., seven applications) was the most outstanding and considerably superior to Bordeaux mixture (8–4–80) in both control of the disease (27 per cent. defoliation as against 57) and effect on yield (355·2 bush. per acre as against 304·1).

Wallin (J. R.). **Prediction of Potato late blight incidence from samples of blighted seed tubers.**—*Amer. Potato J.*, 33, 7, pp. 220–222, 1956.

On farms at Albert Lea and Hollandale, Minnesota, it was impossible to find a clear-cut relationship between the ultimate percentage infection of the crop by *Phytophthora infestans* and the initial percentage tuber infection as determined by observation of samples at the cutting table before planting [cf. *R.A.M.*, 22, p. 401]. At one farm, however, field infection of moderate intensity was seen in a field planted with fairly heavily infected tubers (46 out of 6,300 sampled), as compared with slight or no infection in other fields planted with clean or slightly infected tubers (five out of 2,940).

Wilson (J. D.) & Sleesman (J. P.). **Depression of Potato yields by Bordeaux mixture during a dry summer.**—*Amer. Potato J.*, 33, 6, pp. 177–184, 1956.

In the abnormally dry summer of 1954 Katahdin and Rural Russet potatoes at the Ohio Agricultural Experiment Station, Wooster, were sprayed 12 times at weekly intervals [against *Phytophthora infestans*] with Bordeaux mixture 8:4:100 and

zineb and harvested in three stages at fortnightly intervals, commencing on 16th September, when the tubers were still immature, and finishing on 14th October after frost had killed the vines.

The loss of yield in the Bordeaux-treated plots, as compared with the zineb-treated and the controls, became progressively greater with each harvest, amounting to 110 bush. per acre with Russet and 34 bush. with Katahdin at the last harvest. These data indicate that in the absence of loss from disease Bordeaux mixture may itself reduce yields [*R.A.M.*, 35, p. 629].

Hodgson (W. A.). **Control of Potato late blight with antibiotics.** —*Amer. Potato J.*, 33, 6, pp. 185–186, 1956.

In field tests at the Plant Pathology Division, Science Services, Canada Department of Agriculture, two commercial streptomycin preparations (agrimycin and agristrep) and crude dihydrostreptomycin applied at spray concentrations equivalent to 200 p.p.m. streptomycin base, with Dupont spreader sticker, gave good control of potato blight [*Phytophthora infestans*: cf. *R.A.M.*, 34, p. 100] on the foliage. Dihydrostreptomycin was also effective with glycerine [cf. 35, p. 503] at 45 ml. per gallon in the place of the spreader-sticker, but as blight did not develop early in the crop, and only moderately after subsequent inoculation, significant differences in yield were not obtained.

Niederhauser (J. S.) & Cervantes (J.). **La Papa como cultivo de temporal en los valles altos de México.** [Potato cultivation in the high valleys of Mexico during the rainy season.]—*Foll. Divulg. Secret. Agríc. Ganad.* 20, 43 pp., 16 figs., 1956.

On pp. 29–35 of this publication the authors discuss measures for the control of late blight [*Phytophthora infestans*] of potatoes during the rainy season in Mexico [*R.A.M.*, 34, p. 242]. The importance of the sowing date in relation to the rainy season is emphasized. The best yields in experiments with a number of sprays were obtained with manzate (33·8 tons per ha.), orthocide [captan] (32·7), and parzate (31·9), as opposed to 2·2 for the untreated controls. Bordeaux mixture gave 19·4 tons per ha., but is recommended in preference to the organic fungicides as being more readily available and cheaper.

Nikiforova (Mme N. A.). Светозакалка семенного Картофеля. [Light vigour of the seed Potato.]—Наука и Жизнь [*Sci. & Life, Moscow*], 21, 6, p. 31, 2 figs., 1954. [Received September, 1956.]

Exposure of seed potatoes to sunlight (15° to 20° [C.]) in various parts of the U.S.S.R. induced resistance, both during winter storage and after planting in the field, to a number of diseases. In one experiment tubers exposed for five days remained free from infection by *Phytophthora* [? *infestans*: *R.A.M.*, 35, p. 219] even though artificially inoculated. Those exposed for one day developed slight infection on the 11th day, when the unexposed tubers were already completely diseased.

A spring check on stored tubers intended for planting revealed 14·7 per cent. [unspecified] infection of the unexposed, whereas there was only 3·5 and 1·9 per cent. loss of those exposed five and seven days, respectively.

Ayers (G. W.). **The resistance of Potato varieties to storage decay caused by Fusarium sambucinum f. 6 and Fusarium coeruleum.**—*Amer. Potato J.*, 33, 8, pp. 249–254, 1956.

The author describes the methods used to grade the resistance of various named and unnamed potato varieties to tuber decay caused by *Fusarium sambucinum* f. 6 [*Gibberella cyanogena*] and *F. caeruleum* in relation to the susceptible varieties Sebago and Keswick. The results, but not the method, have already been noticed [*R.A.M.*, 35, p. 323].

For each variety 80 tubers were twice wounded by puncturing to a depth of 2·4 cm., and then placed in a spore suspension of the fungus, being afterwards dried off and stored at 40° to 45° F. They were examined after five months, and infection graded from 0 to six. Results were expressed in terms of a percentage rot index calculated as follows:

$$\frac{\text{sum of ratings} \times 100}{\text{number of inoculations} \times 6}.$$

Teton, Chippewa, and Pontiac were susceptible to decay by *F. sambucinum*; nine other varieties [loc. cit.] showed moderate to high resistance. The varieties Warba, White Cloud, Cayuga, and Pontiac were highly susceptible to *F. caeruleum*, whereas moderate to high resistance was displayed by nine others [loc. cit.].

Gregory (K. F.) & Vaisey (E. B.). **Pathogenicity of tyrosinase-deficient mutants of Streptomyces scabies.**—*Canad. J. Microbiol.*, 2, 2, pp. 65–71, 1 pl., 1956.

At the Department of Botany, Ontario Agricultural College, 12 natural mutants of *Streptomyces* [*Actinomyces*] *scabies* on agar media or induced by X-rays were tyrosinase-deficient and were also unable to produce a brown ring on separated milk [*R.A.M.*, 35, p. 322]. An additional 80 brown-ring positive actinomycetes were shown to produce tyrosinase, so the two reactions are considered identical. There was no back mutation of deficient mutants to tyrosinase production. In greenhouse tests the tyrosinase-deficient mutants were all pathogenic to Katahdin potatoes. There was a distinct correlation between sporing ability and percentage scab produced.

Douglas (R. J.) & San Clemente (C. L.). **Respiration of scab-producing strains of Actinomycetes.**—*Canad. J. Microbiol.*, 2, 4, pp. 407–415, 6 graphs, 1956.

Homogenized suspensions of *Streptomyces* [*Actinomyces*] *scabies* [see preceding abstract] oxidized a number of organic acids in studies at the Department of Bacteriology, Ontario Agricultural College. The high endogenous respiration rate was supported, in part at least, by nitrogenous substances.

McClean (J. G.). **Selecting and breeding Potatoes for field resistance to Verticillium wilt in Idaho.**—*Res. Bull. Idaho agric. Exp. Sta.* 30, 19 pp., 2 figs., 4 graphs, 1955.

Losses of 20 per cent., increasing to 50 per cent. on dry, sandy soils, are caused to potatoes by *Verticillium* wilt (*V. albo-atrum*) in Idaho [cf. *R.A.M.*, 35, p. 484]. Disease intensity is increased by conditions hastening maturity, such as earliness of variety, early planting and irrigation, and high temperatures. The use of seed tubers only six months from planting instead of the usual year-old seed checked the disease. The moderate resistance of such varieties as Mohawk and Sebago could be broken down by severe changes in environment. The late varieties Empire, Harford, Induna, Menominee, Populair, Potomac, Saramac, Sequoia, Wilpo, and A.C. 25669, 25673, and 25680 and the medium-maturing 41956 were highly resistant in four years of testing.

Waggoner (P. E.). **Chemotherapy of Verticillium wilt of Potatoes in Connecticut 1955.**—*Amer. Potato J.*, 33, 7, pp. 223–225, 1956.

The author reports attempts to control wilt of potato (*Verticillium albo-atrum*) [cf. *R.A.M.*, 35, p. 226] by spraying with 2,4-D and complexes of cobalt and cadmium (500 p.p.m. of metal) and aluminium (100 p.p.m.), and by drenching the soil with zinc complex (33 p.p.m.). Damage caused by 2, 4-D, probably augmented by dry weather, exceeded the benefits obtained by alleviation of wilt symptoms. The metal treatments, with the possible exception of cadmium and aluminium in

one field, were without effect, but it was concluded that chemotherapy with fungicidal metals had not been adequately tested, as the concentrations attained in the host stem were not high enough.

GIGANTE (R.). **Esperienze sulla maculatura ferruginea dei tuberi di Patata in Sicilia.** [Experiments on rust spot of Potato tubers in Sicily.]—*Boll. Staz. Pat. veg. Roma*, Ser. 3, 13 (*1955*), pp. 61–66, 3 figs., 1956. [English summary.]

Continuing his studies on internal rust spot of potatoes [*R.A.M.*, 35, p. 485], the author, at the end of October, 1954, planted badly spotted Home Guard and spotted and non-spotted Majestic tubers at Acireale, Sicily, in the same fields as those in which some of the earlier experiments had been conducted. During the growth of the plants and development of the new tubers the weather remained normal and no sudden fluctuations occurred in the moisture content of the soil. The potatoes were lifted in April, 1955, and in all four plots together the incidence of rust spot scarcely amounted to 1 per cent., supporting the view that internal rust spot results from alternation of dry and wet periods during the maturation of the tubers [loc. cit.].

FRANDSEN (N. O.). **Rasse 4 von Phytophthora infestans als Feldrasse in Deutschland.** [Race 4 of *Phytophthora infestans* as a field race in Germany.]—*Phytopath. Z.*, 26, 2, pp. 124–130, 1956.

An analysis at the Max Planck Institute for Breeding Research, Köln-Vogelsang, of 34 field collections of potato leaves infected by *Phytophthora infestans* in various districts of Lower Saxony and Schleswig-Holstein revealed the predominance of race 4 [cf. *R.A.M.*, 34, p. 610], which occurred in all except one. A single sample yielded race 1,4, while 0 (originally known as A and still preponderant in 1951) was entirely absent. The prevalence of race 4 did not appear to have modified relative field resistance, e.g., in the early-maturing clone No. 49,536/13, specially developed at the Institute for this quality. Various problems connected with racial differentiation and the international system of race nomenclature [33, p. 250] are discussed.

HILDEBRAND (E. M.). **Cork virus leafspots on Triumph Sweet-potato contain separated parenchyma cells.**—*Science*, 123, 3206, pp. 1034–1035, 1 fig., 1956.

In 1954 Triumph sweet potatoes growing in a greenhouse at Beltsville, Maryland, developed chlorotic leaf spots, which later enlarged and became translucent, and were followed by necrosis. The parenchyma cells were free and readily separated from one another as a result of the dissolution of the calcium pectate intercellular substance, presumably by enzyme action. These translucent spots were later shown by indexing to be symptoms of the internal cork virus [*R.A.M.*, 35, p. 632].

CORBETTA (G.). **Le alterazioni parassitarie del Riso e loro consequenze su conservazione e lavorazione industriale.** [Parasitic changes in Rice and their effects on storage and industrial processing.]—*Riso*, 4, 3, pp. 12–15, 8 figs., 1955. [English summary.]

Brief notes are given on the symptoms caused on the spikelets of rice in Italy and the injury produced in processed rice by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: *R.A.M.*, 34, p. 813], *Piricularia oryzae* [loc. cit.], *Epicoccum purpurascens* [28, p. 487], and *Fusarium moniliforme* [*Gibberella fujikuroi*] [34, p. 46]. A black discoloration of parboiled rice, which is submitted to commercial treatment by hot water and steam, was ascertained to be due to infection by certain of these fungi [unspecified].

Refatti (E.). **Osservazioni su la morfologia, la germinabilità e su una parziale pigmentazione delle spore di Piricularia oryzae Br. et Cav. in coltura.** [Observations on the morphology, germinability, and a partial pigmentation of the spores of *Piricularia oryzae* Br. & Cav. in culture.]—*Ann. Sper. agr.*, N.S., 9, 4, *Suppl.* pp. vii–xxi, 2 figs., 1955. [English summary.]

At the Regional Observatory of Phytopathology, Milan, a strain of *Piricularia oryzae* [cf. *R.A.M.*, 27, p. 581, *et passim*], isolated from rice plants affected by 'blast', after about 30 days' growth in culture produced spores with a brown median cell, a brown median and a brown basal cell, or (occasionally) a brown basal cell only, as well as completely hyaline spores. Subsequently, the proportion of spores with brown pigmentation increased. They were slightly longer (average 26·5 $\mu$) than the hyaline spores (24·8 $\mu$). These modifications may, possibly, represent an overwintering form of the fungus, or they may (though this is less likely) be due to an accumulation of pigments from the medium.

Germination in water of hyaline spores from young cultures began at 10° C., increased rapidly with rising temperature, reaching 99 per cent. after 72 hours at 25°, and ceased at 40°. There was no germination of brown spores from cultures 36 days old.

After a germination period of 24 hours, some spores developed two, three, or five germ tubes, but most had only one; later, other tubes might arise from the same cells or from other cells of the same spore. Germination was more frequent at the apical cell.

Fukunaga (K.), Misato (T.), Ishii (I.), Asakawa (M.), Katagiri (M.), & Maekawa (S.). **Application of antibiotics to agricultural chemicals. I. Screening of antifungal actinomycetes against Piricularia oryzae.**—*Ann. phytopath. Soc. Japan*, 20, 2–3, pp. 95–99, 1955. [Japanese, with English summary. Received 1956.]

Of 140 actinomycetes selected at Tokyo University for their antifungal activity, 12 were particularly active against *Piricularia oryzae*, the agent of rice blast [*R.A.M.*, 35, pp. 40, 713], in tests of their culture filtrates by the agar-cup method. Conidial germination was inhibited by the filtrates. In greenhouse experiments rice plants grown in water culture to which the filtrates had been added exhibited increased resistance to *P. oryzae*. Two of the actinomycetes were finally selected as the most promising against the disease.

Yoshimura (S.). **On the scale for estimating degree of severity of sheath blight by Hypochnus sasakii Shirai in Rice plant.** *Ann. phytopath. Soc. Japan*, 19, 1–2, pp. 58–60, 1 fig., 1954.

The formula proposed for estimating the degree of damage (percentage severity) to rice plants infected by sheath blight (*Hypochnus* [*Corticium*] *sasakii*) [*R.A.M.*, 35, p. 40] is $\frac{3n_1-2n_2-1n_3-0n_4}{3N} \times 100$ where $N$ is the sum of the number of stems ($n$) having one, two, three, or four of the upper leaf sheaths healthy. According to this scale in fungicide trials on small plots the degree of damage was reduced from 30 per cent. (control) to 9·9 per cent. by nichino suigin dust and to 11·3 to 14 by various makes of Bordeaux mixture. In a second test the figures were: control 23·3, and sun Bordeaux 12·8.

Yamada (W.), Shiomi (T.), & Yamamoto (H.). **Studies on the stripe disease of Rice plant. II. On the disease occurrence in Okayama prefecture and its control.** *Spec. Bull. Okayama Prefect. agric. Exp. Sta.* 52, pp. 113–124, 1 graph, 1955. [Japanese, with English summary.]

Further observations on the rice stripe virus [*R.A.M.*, 35, p. 632] indicated that

it had occurred regularly in Okayama prefecture, Japan, since its first recording in 1935. Control could only be obtained by treating the nurseries four or five times in June with an insecticide to kill the vector, *Delphacodes striatella*.

PICHEL (R. J.). **Les pourridiés de l'Hévéa dans la cuvette congolaise.** [The root rots of *Hevea* in the Congo basin.]—*Publ. Inst. nat. agron. Congo belge*. Sér. tech., 49, 480 pp., 142 figs. (44 col.), 6 diags., 31 graphs, 1 col. map, 1956. Fr. 400.

The first part of this useful and well-illustrated work (prepared with the collaboration in the field of C. MAERTENS) consists of two chapters, of which the first (pp. 15–26) reviews the history of investigations into the root rots of *Hevea* rubber caused by fungi of the *Fomes* group and *Armillaria mellea* in the Belgian Congo and elsewhere, while the second (pp. 27–117) gives a full account, with numerous references, of the systematics, geographical distribution, hosts, and diagnosis of *F. lignosus*, *A. mellea*, *Ganoderma pseudoferreum*, and *F. noxius* [cf. *R.A.M.*, 35, p. 231 *et passim*].

The second part (pp. 121–231) treats of the biology of *F. lignosus* and *A. mellea* and the susceptibility to them of different lines of rubber. The matters dealt with include, *inter alia*, foci of infection and contamination, parasitism, and the influence of environmental factors.

In the third and principal section (pp. 235–379), a detailed account is presented of six years' experiments carried out at Yangambi, Belgian Congo, on the epidemiology and control of *F. lignosus* and *A. mellea*. The fourth part deals with the effectiveness of the control methods tested and the economic aspects of the problem.

The recommendations made are primarily for the Belgian Congo. If plantings are to be established in forest clearings, light soils containing under 20 per cent. clay should be avoided. The forest trees may either be cut down several years before planting, or they may be ringed and poisoned, or the stumps may be poisoned immediately after felling.

Sanitary inspection should start when the trees are two or three years old and be carried out regularly at intervals of not more than six months: an interval of four months is preferable until the trees are six years old. After ten years a few final yearly inspections may be made. Rubber trees need not be extirpated unless the lateral roots and more than half the tap root are severely infected.

If *Hevea* follows coffee or palm trees, infection will be potentially slight and treatment is unnecessary. If *Hevea* follows *Hevea*, careful phytosanitation to remove sources of infection is essential. Trees unaffected by root rots can then be ringed and poisoned while standing. Initially dense replanting will permit the early detection and elimination of any remaining sources of infection.

COLES (G. V.), MARTIN (J. T.), & BYRDE (R. J. W.). **The fungicidal properties of coal tar distillates : progress report II.** —*Rep. agric. hort. Res. Sta. Bristol. 1954*, pp. 74–82 [1955].

In further investigations in this series at Long Ashton Research Station, Bristol [cf. *R.A.M.*, 34, p. 611], a new method of analysing the tar oil fungicides was evolved whereby phenols, bases, and neutral oil could be determined after the separation of water and formulating solids.

Ten fungicides received from Malaya and their products obtained by this method were tested against *Ceratostomella* [*Ceratocystis*] *fimbriata* [loc. cit.], responsible for mouldy rot of rubber. The results confirmed the previous findings. Material C (containing 28·9 per cent. phenols) was the most toxic of the group tested pre-

viously, giving up to 81·5 per cent. inhibition of mycelial growth. Of the new products, G was the most active, completely inhibiting the fungus at 400 p.p.m. It appears that by these methods the phenol contents alone give a measure of the fungicidal activity of the product. No synergistic effect could be detected between phenols and neutral oil.

Heinisch (K. F.) & Kühr (P.). **De groei van schimmels op Rubber.** [The growth of moulds on Rubber.] *Bergcultures*, 25, 15, pp. 363, 365, 366 367, 369 371, 373, 2 figs., 5 graphs, 1956. [English and Indonesian summaries.]

The results of exploratory studies at the General Experiment Station of AVROS, Medan, Sumatra, on the conditions requisite for mould growth on sheet rubber [*R.A.M.*, 34, p. 178] are fully reported and discussed in relation to 15 contributions to the literature on the subject. The fungi were found to develop only at a relative atmospheric humidity of about 77 per cent. and a moisture content in the rubber of 0·8 per cent. Within a range of 21° to 37° C. mould growth increased parallel with rising temperatures, the average optimum lying between 37° and 40°.

In the early stages the predominant species on smoked sheet were *Penicillium* and *Aspergillus*, including *P. glaucum*, *P. notatum*, and *A. griseus*, *Mucor* sp., and *Fusarium* sp. They were responsible for a mainly grey-green discoloration, which slowly turned to pink, orange, yellow, red, purple, or black under the action of other species, e.g., *A. flavus*, *A. ustus* or *A. tamarii*, *A. niger*, and *P.* sp. The microscopic examination of discoloured samples of crepe from two east coast estates revealed *A. niger* as the producer of blue-black areas and *A.* (?) *ochraceus* and *Monascus* sp. of red ones. The same material yielded *A. luchuensis* and *Rhizopus stolonifer* [*R. nigricans*]. Secondary factors contributing to the defect are a high content of non-rubber constituents, e.g., quebrachite, favourable to mould growth, contamination in drying houses, unduly prolonged maintenance in a wet state, absorption of moisture during grading, and so forth. The mycelia were not confined to the surface but permeated the rubber completely.

A quantitative nephelometric method proved satisfactory for the determination of mould growth. Samples measuring 3 by 1 cm. were conditioned for 48 hours at a temperature of 21° and a relative moisture content of ± 60 per cent. They were then laid on filter paper, inoculated with mould suspensions, placed in test tubes, and kept at 98 per cent. relative humidity over a 7 per cent. sodium chloride solution in a desiccator jar. Fungal growth was assessed by 10 minutes' vigorous shaking of the samples in the tubes with 10 ml. distilled water and 0·5 gm. coarse sand to scour the mould from the rubber and bring it into suspension so that the degree of turbidity could be gauged by means of a 'Hilger-Spekker' colorimeter.

The growth of *A. niger* on a liquid nutrient medium was completely inhibited by 15 minutes' immersion of the samples in DDM (2,2′ dihydroxy-5,5′-dichloro-diphenyl methane), supplied by Imperial Chemical Industries, at a dilution of 1 in 50,000; shirlan (I.C.I.) at 1 in 20,000; raschit K, preventol ON, and preventol ON Extra [cf. 33, p. 311] at 1 in 10,000; and antimucin WB (organic mercurial from Sandoz, Ltd., Basle) and gefesin (Gesellschaft für Sterilisation, Berlin) at 1 in 5,000. Added to the latex, the fungicides did not give such good results, and their efficiency was further reduced by the presence of proteins in the substratum.

In the case of smoked sheet neither colour nor the extent of smoking afforded a clue to the preservative effect of the process.

Galli (F.). **Alguns factores que afetam o desenvolvimento dos microorganismos do solo.** [Some factors affecting the development of soil micro-organisms.] *Rev. agric. Piracicaba*, 31, 2, pp. 85–92, 1956.

On the basis of 21 contributions to the relevant literature the author briefly

discusses the influence of the following factors on the development of soil fungi, actinomycetes, and bacteria: soil reaction, humidity, temperature, the rhizosphere, insecticides and herbicides, and antagonism and antibiotics.

CORKE (C. T.) & CHASE (F. E.). **The selective enumeration of actinomycetes in the presence of large numbers of fungi.**—*Canad. J. Microbiol.*, 2, 1, pp. 12–16, 2 graphs, 1956.

In studies on the microbiology of acid forest soils at the Department of Bacteriology, Ontario Agricultural College, actidione proved to be superior to sodium propionate [*R.A.M.*, 30, p. 382] as a fungal inhibitor in an actinomycete plating medium. The most suitable concentration of antibiotic in tests with samples from the organic layer of forest plots was 40 μgm. per ml. medium. A concentration of 100 μgm. actidione failed to inhibit 85 actinomycetes isolated from agricultural and forest soils.

NICHOLAS (D. J. D.). **Trace element disorders in crops.**—*Chem. Prod.*, 18, 5, pp 175–178, 6 figs., 1956.

Essential information is presented on the diagnosis (by the visual method, chemical analysis, and microbiological assay with *Aspergillus niger*) and correction of iron, manganese, boron, zinc, copper, and molybdenum deficiency in commercial crops by soil amendments with chemical products.

CHRISTIE (T.). **A note on an outbreak of Verticillium wilt in a Nelson Hop garden.**—*N.Z. J. Sci. Tech.*, Sect. A, 38, 1, pp. 15–16, 1956.

Following an outbreak of wilt in a hop garden in the Tadmor district, New Zealand, where potatoes had grown the previous year [*R.A.M.*, 34, p. 214] *Verticillium albo-atrum* was isolated from the diseased hops and *V. dahliae* from a rogue potato among them, suggesting the presence of both species in the previous potato crop, though *V. albo-atrum* was not obtained from the rogue potatoes.

CHRISTIE (T.). **Pathogenicity tests with species of Verticillium.**—*N.Z. J. Sci. Tech.*, Sect. A, 38, 1, pp. 17–19, 1956.

Experiments at the Cawthron Institute, Nelson, New Zealand, indicated differences in the pathogenicity of strains of *Verticillium* to tomato, potato, and hop plants. The local hop strain of *V. albo-atrum* [see preceding abstract] and the tomato strain of *V. dahliae* [*R.A.M.*, 35, p. 236] were equally pathogenic to tomato. Similarly, the hop strain of *V. albo-atrum* and the potato strain of *V. dahliae* were markedly pathogenic to potato. The tobacco strain of *V. dahliae* [34, p. 215] produced no symptoms on either tomato or potato.

When the local strain and the English 'fluctuating wilt' strain of *V. albo-atrum* were tested on the Californian and Fuggle varieties of hops [loc. cit.], the former affected the Californian more markedly than the latter, and vice versa with the Fuggle, but both infected the Fuggle more severely than the Californian plants. The tomato, tobacco, and potato strains of *V. dahliae* did not infect the Californian hop variety.

TALBOYS (P. W.) & WILSON (J. F.). **A study of wilt-tolerance in the Hop by means of intervarietal graft complexes.**—*Rep. E. Malling Res. Sta., 1955*, pp. 126–130, 4 diags., 1956.

In further studies of hop wilt (*Verticillium albo-atrum*) [*R.A.M.*, 34, p. 751] plants of the wilt-sensitive variety Fuggle and the tolerant OR/55 were grown in 7-in. pots to a height of 18 to 24 in. In two experiments approach grafts were made

between pairs of plants of the same or different varieties, so that the stem of one (the experimental stem) was put into direct contact with the root systems of the two plants. In some a preliminary top graft of Fuggle on OR/55 roots or vice versa had been made in one of the pair, the subsequent approach graft being made so that the experimental stem drew on roots of different varieties.

Inoculations were made by the introduction of diseased tissue into the soil in one or other of the parent pots. In one series they were all made through the sensitive variety, and in each combination all the plants wilted, indicating that roots of a tolerant variety do not protect the upper part of the plants either by translocation of substances inhibitory to the fungus or by stimulation of resistance mechanisms. In the second series inoculation was via the roots of the tolerant variety. The results were less clear cut, but indicated that with a sensitive stem and/or uninoculated root system disease incidence was greater, though the downward growth of the fungus in some combinations, from the graft towards the Fuggle roots, introduced an additional factor. The general conclusion, however, was that no upward translocation of a fungal accelerator or sensitising factor from sensitive roots took place. When uninoculated pairs of the same variety were grafted and the root system under the experimental stem subsequently severed, no wilting of either stem resulted, indicating that in the previous experiments death was not directly associated with attenuation of the root system.

In a fourth series young plants of either variety were top grafted with the other, which then grew up through the base of a whale hide pot where production of adventitious roots by the scion was induced. Inoculations were then made via the roots of either the stock or the scion. Infection of sensitive roots of either resulted in death. Infection of the adventitious roots of the tolerant scion produced no wilting (so that no sensitising factor appeared to have been brought up from the stock). With inoculation of a tolerant stock, however, all the sensitive scions died, *Verticillium* growing outwards into their adventitious roots.

These results substantiate previous evidence [24, p. 343; 32, p. 399] to indicate that in wilt of both hop and tomato the intensity of symptoms is dependent on inherent varietal characteristics of the root system not associated with translocation of specific substances from uninfected roots to the stems. Entry of a virulent pathogen by any means into the roots of a sensitive variety creates conditions favourable to development of acute symptoms. When the stem shows visible wilt symptoms, the stage at which factors operate to determine the intensity of these symptoms has been passed. To understand the mechanisms of host tolerance and fungal pathogenicity the means by which vascular infection is initially established must be studied, in addition to the behaviour of the pathogen in the stem.

PESANTE (A.). **La 'moria' della Menta in Piemonte.** [Wilt of Peppermint in Piedmont.]—*Ann. Sper. agr.*, N.S., 9, 5, pp. 967–974, 1 col. pl., 3 figs., 1955. [English summary.]

Since 1937, peppermint (*Mentha piperita* var. *officinalis* f. *rubescens*) growing in Piedmont, Italy, has been affected by a wilt disease, which has become so severe that the crop may have to be permanently abandoned. Affected plants occur singly or in groups among healthy ones. If healthy seedlings are planted in soil that has not grown peppermint before, little, if any, disease is present in the first year, but if the same crop is grown continuously or at intervals of a few years, the disease becomes progressively worse. Some affected plants produce a small terminal flower spike, while others do not flower at all. Isolations from blackened bases of stalks gave *Verticillium albo-atrum* [cf. *R.A.M.*, 35, p. 633], apparently not recorded before in Europe on this host. Control by the development of resistant varieties would appear to offer the best prospect of success.

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